Camp Cozy Park
Natural Resources Management Plan

Prepared for:
The City of Elk River, Minnesota

Prepared by:
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Fall 2023

This Natural Areas Management Plan and associated Work Plan have been reviewed and approved by:

City of Elk River Parks and Recreation Commission

_____ Date: 4-10-24

Chair

City of Elk River

_____ Date: 4/10/2024

City Representative

TABLE OF CONTENTS

FIGURES AND TABLES

EXECUTIVE SUMMARY

Background

This document was drafted by Friends of the Mississippi River (FMR) in 2023 to guide the restoration and management of Camp Cozy Park in Elk River, Minnesota. The property encompasses approximately 48 acres in Elk River, Minnesota and is located on the north bank of the Elk River. Community values around Camp Cozy's rare native plant communities and location on the Elk River point to preservation and restoration, and this natural resources management plan (NRMP) provides a framework for those goals while also carving out areas that are suitable for park programming.

The NRMP is intended to guide management of the natural features of Camp Cozy Park with a focus on restoration and preservation of native plant communities with the goals of improving wildlife habitat and water quality. This focus provides specific recommendations on natural resource management which are complementary to work contemplated by broader Elk River Parks and Recreation Master Planning to be conducted in 2025. Areas of the park that are best suited to future park improvements and programming are carved out of management units where restoration activities are recommended. This separation ensures that future state grant-funded restoration areas will not conflict with future park improvements.

The site's location adjacent to the Elk River and proximity to the confluence of the Elk and Mississippi Rivers may point to a long history of Indigenous use. The vegetation community around the time of the public land survey of Minnesota (1847-1907) was classified as "Oak opening and barrens." This cover type is most closely associated with today's oak savannas that feature large, open grown bur oak, and to a lesser extent, white oak, with a grass-dominated herbaceous layer. The open understories of oak barrens persisted with frequent wildfires or human-ignited burning to suppress woody encroachment and favor the growth of food plants, while the oaks' thick and corky bark provided protection from fire.

The property's more recent documented history includes its use as a private resort and campground in the 1920s (Figure 1). At that time, people regarded Camp Cozy as a technological marvel with its series of canals and flues which allowed canoes to float a circuit down the Elk River and up through the resort; these canals are still visible today 100 years later. After the closure of Camp Cozy during the Great Depression, it reopened in the late 1930s as a bar, dance hall, roller rink and fast-food restaurant. Camp Cozy lived on as a gathering place for Elk River into the 1950s until a portion of the resort burned, and the remainder of the land was sold. (Mike Brubaker, Sherburne History Center)

Figure 1: Camp Cozy ca. 1938. Credit: LeeAnn Watzke, Sherburne History Center

There has been a long history of agriculture in this area of the County, and agriculture continues to dominate the overall landscape. However, the area directly around the property is now mostly in seasonal and permanent residential use, which reflects the conversion of remnant plant communities, agriculture and pasture lands as the City of Elk River expands. Historically, conversion of prairie and savanna habitat led to the loss of many native plant and animal species. Existing conditions show evidence of imperiled plant communities and a proliferation of invasive vegetation. Camp Cozy has primarily been used for passive recreation and cross-country running races, and controlled archery hunting is permitted as part of the city's white-tailed deer management program. These uses are easily compatible with targeted, intentional management of invasive plants and the return of historic disturbance regimes, such as fire, which will preserve these unique habitats for generations to come.

Driven by the rarity of natural ecosystems in this matrix of residential and agricultural lands and degradation from invasive species and other land use practices, this plan recommends restoring native plant communities on the site. Restoration of prairie and oak savanna communities on the site is prioritized as these habitats are among the most in need of restoration in this ecological subsection, the Anoka Sandplain/Big Woods subsections. Vegetation and breeding bird surveys are also recommended by this plan to monitor the site for plant and bird diversity, the measure of which would show trends in the site's ability to provide improved habitat.

Natural Resources Inventory and Assessment

A natural resources inventory and assessment was conducted by FMR ecologists during the summer of 2023 to determine existing plant and wildlife communities, identify opportunities for restoration, and develop guidance for long-term public use. The Camp Cozy site consists of five primary vegetation cover types: remnant dry prairie, oak forest, mixed deciduous forest, terrace forest, and floodplain forest. These cover types occur in eight distinct units across the park.

The most notable and imperiled features of the property from an ecological perspective are the two remnant dry prairies in the central north and central south portions of the park now comprising 15.3 acres. These plant communities, likely remnants of plant communities present at the time of European colonization, are part of 0.1% of the remaining native prairie in Minnesota, which once covered two-thirds of the state. In the absence of natural disturbance regimes, woody species have encroached into the perimeters of both remnant prairies at Camp Cozy. In addition to a mowed, natural surface main trail that encircles and connects the two prairies, several mowed spur trails loop through the prairies.

Oak forest and mixed deciduous forest encircle the remnant prairies in the upland areas. The forest plant communities exhibit a range of quality with some intact native plant communities, and other areas have been degraded by non-native, invasive woody and herbaceous species. Very small mesic prairie remnants occur in three distinct areas surrounded by oak forest.

A plant community resembling a southern terrace forest is present on the southwestern edge of the park, and vegetation characteristics synonymous with terrace forests continue to the east-central edge of the site due to dredging in the 1920's. These channels receive flashy flows during rapid snowmelt and heavy rains and are undercut and not well-vegetated.

A floodplain forest is present within an oxbow of the Elk River at the eastern extent of the park. High quality wetlands with high species diversity are present here, but the floodplain appears to be frequently inundated, and a significant amount of trash has littered the area.

Maintenance, restoration and preservation efforts within Camp Cozy have been limited. Several wide trails are maintained by mowing throughout the prairie remnants, and narrow footpaths are present in the forested areas. Vegetation management has been restricted to a single prescribed burn of the prairies conducted by volunteers and an Eagle Scout candidate more than 20 years ago. Elk River City Council meeting minutes from 2003 include a report on this prescribed burn and indicate that 5 acres of a 10-acre prairie and an additional 10 acres of a 20-acre prairie were burned and seeded. While the prairie acreage may have been overstated in 2003, in 20 years' time, the extent of prairie at Camp Cozy has been greatly reduced due to woody encroachment. Typically, a fire return interval of 4-5 years would suppress woody species and weedy cool season grasses that are present in the prairies at Camp Cozy. The lack of burning in the fire-dependent prairies has allowed woody species – both native and non-

native – to become overabundant. The habitat that these remnant plant communities provide will be completely lost if fire and other disturbances are not reintroduced.

Common buckthorn dominates several areas of the forest understory, and in addition to displacement of native shrubs that provide superior habitat, buckthorn shades and suppresses herbaceous forest plants causing large areas of bare soil that are prone to erosion. Buckthorn-dominated areas are adjacent to the channels in the southern third of the park, and the combination of low vegetative cover in the forest and flashy flows in the channels is leading to soil loss and erosion. Herbaceous weedy species such as garlic mustard and creeping Charlie are present in patches. These issues should be resolved as resources allow. Future issues should also be considered in planning budgets and timelines of management. In particular, the population of ash trees on the property is at risk from emerald ash borer infestation. Understanding future risks and their likelihoods can help design and prepare future management strategies.

Natural Resource Management Recommendations

Natural resource management recommendations for Camp Cozy Park are based on the resource assessment conducted by FMR ecologists, past land use and management activities, the goals and perspectives of the City of Elk River Parks Department, and the community's desired uses of the park. The recommendations stem from general ecological guidelines for these types of landscapes set by the Minnesota Department of Natural Resources (MNDNR) in consideration of native plant communities of Minnesota, accepted practices for restoration and protection of native habitats and incorporation of compatible public use.

This plan recommends the restoration and preservation of the remnant prairies within Camp Cozy Park, reduction or elimination of non-native woody species in the forest areas and progressive management of herbaceous invasive species. Because of the imperiled state of the remnant prairies, management and intervention in these units is the priority. Removal of woody encroachment by hand-cutting and treating stumps followed by spot management to eliminate resprouting trees and shrubs would allow sun-loving prairie species to rebound. Fire would be reintroduced to the prairies by prescribed burning with supplemental seeding used to diversify the plant community.

Secondarily, the removal of mature buckthorn in the forests with follow-up management of smaller and newly germinating buckthorn should be pursued. Forest management units could be grouped for concurrent management and the work phased over several years to distribute costs and reduce overall site disturbance to this publicly used space. Over time, reintroduction of native species will provide longevity of these plant communities.

Tertiarily, the number of trails within the northern prairie could be reduced to create more contiguous habitat and reduce park maintenance. The community has also expressed the desire for a trail that would allow access to the river's floodplain and the river itself. Such a trail could

lead to a future canoe launch on the Elk River, which was also an amenity of interest to the community.

In addition, vegetation, breeding bird, and pollinator surveys are recommended to monitor the site for plant, bird, and pollinator diversity, the measure of which would indicate whether the management activities are successful and wildlife habitat is improving.

The estimated cost for restoration and maintenance of the remnant prairies is $59,278. The estimated cost of management of invasive woody species in the forest is $113,650. These are the highest priorities and should be undertaken as soon as possible to preserve the plant communities and associated habitat. A comprehensive restoration process would take approximately 5 years at an estimated cost of $172,928 if all activities are undertaken and contracted. FMR will continue to assist with obtaining grant funding for restoration and enhancement, as well as with the coordination and management of restoration activities.

INTRODUCTION

This Natural Resource Management Plan presents the site analysis and recommended management and land use activities for the 48-acre Camp Cozy Park in Elk River, Minnesota. This document can be revised only by written agreement by the City of Elk River, MN and Friends of the Mississippi River.

Camp Cozy Park is owned by the City of Elk River, Minnesota. Camp Cozy's name is a nod to its history as a riverside resort in the 1920s and 1930s, which featured camping and hand-dug channels that allowed paddlers to canoe a circuit through the resort and along the Elk River. The park is located on the western edge of the city and sits on the north bank of the Elk River approximately 5 miles of the Elk's confluence with the Mississippi River. The Elk River is freely flowing in this stretch with many small islands and channels connecting the river to its floodplain. In addition to a wide floodplain and terrace forest, Camp Cozy Park features oak forest and two remnant dry prairies.

The property is approximately 2,400 feet long and 1,500 feet wide at its maxima. The core of the city of Elk River lies to the east of the property, and US-10 runs to the south of the property across the river. Vintage private residences flank the property's boundaries on the west, north, and east edges.

The property can be divided into four primary areas: the upland dry prairies, the upland oak forest, the terrace forest and the floodplain. The site's topography is relatively flat and grades from the river channel at 874 feet above sea level (FASL) to 886 FASL at the center of the northern prairie. Four specific soil types are present within the park with three of those types attributed to the Elkriver soil series. This series consists of very deep, somewhat poorly and moderately well drained soils that formed in postglacial alluvium consisting of a coarse-loamy mantle and underlying sandy sediments on flood plains. These soils have moderate and moderately rapid permeability in the upper part and rapid permeability in the underlying material. The northwestern forest, northern prairie, southern forest and southern remnant prairie have these fine, sandy loams that are rarely flooded. The eastern and central forest areas that extend to the park's southern floodplain have fine sandy loams that are occasionally flooded. The floodplain terrace has a more unique soil complex made up of both very poorly drained and poorly drained soils with sandy particle sizes.

Camp Cozy Park is located at the southern edge of the *Anoka Sandplain* ecological subsection, just north of its boundary with the *Big Woods* subsection, as designated by the Minnesota DNR (Figure 16). This subsection lies within the *Minnesota and Northeast Iowa Morainal* section in the *Eastern Broadleaf Forest* province of the state. The property is also situated directly within the Metro Conservation Corridors system (Figure 3), an important habitat network defined by the DNR for both sedentary and migratory plant and animal life in and around the Twin Cities. The property is also surrounded by a variety of land units identified by the Minnesota County Biological Survey (MCBS) as areas of biological significance (Figure 3).

Camp Cozy Park presents a unique opportunity to preserve remnant prairies of which only 0.1% remains from the original prairie extent at the time of European colonization. Prairie plant communities, because of their rarity and unique plant structure composition, provide vital habitat for many declining species. As an example, grassland bird species show the greatest rate of decline of any group in North America. Diverse prairies with blooms throughout the year also provide a consistent source of nectar and pollen for the federally endangered rusty-patch bumblebee among other important pollinators. Given Camp Cozy's unique position on the landscape – on the Elk River and located within the Metro Conservation Corridors – restoration and protection of this property would have a large impact on migrating species by providing high-quality habitat.

The Minnesota Department of Natural Resources (MNDNR) recommends stabilizing and increasing SGCN populations in oak savanna and prairie areas by managing invasive species, using prescribed fire and other practices to maintain savanna and prairie, to encourage restoration efforts, to manage grasslands adjacent to native prairie to enhance habitat, and to provide technical assistance and protection opportunities to interested individuals and organizations.

Based on information derived from public land surveys of Minnesota in the late 19th century, the pre-settlement vegetation for this site was largely "oak openings and barrens." In its current state, the site has been greatly altered by the expansion of forest as a result of fire suppression and non-native woody species. Restoring prairie and other native plant communities within the park will be one of the top priorities of this management plan.

The purposes of this management plan are to:

- Document the existing ecological conditions within the park
- Identify and recommend best management practices to maximize habitat values and retain and improve water quality and increase plant community diversity
- Identify uses of the park that are compatible with natural resources goals and provide unique recreational opportunities to the community

Specific ecological and cultural goals for this property are to:

- Maximize coverage and diversity of native plant species and minimize non-native, invasive species
- Provide connectivity with other natural areas in the landscape and along the river corridor
- Maintain and manage the property for water quality through thoughtful trail planning and by remaining responsive to the effects of floodwaters
- Create a model for responsible public land stewardship
- Utilize this property to guide surface water management activities on adjacent land in a manner that protects and fosters natural community establishment
- Utilize this property to enhance and expand the ecological functions of the area

SITE INFORMATION

Owner name, address, city/township, county and phone:
City of Elk River, Minnesota
1801 Main Street
Elk River, MN 55330
Sherburne County
Contact Person: Michael Hecker, Parks and Recreation Director
763-365-1161

Township, range, section:
T33N, R26W, Section 31.

Watershed:
Clearwater-Elk Watershed

Parcel Identification Numbers (Figure 2):
75-131-2200
75-131-2430

Rare Features:
No rare features have been documented on the property. Blanding's turtle (threatened status in Minnesota) and black sandshell mussel (special concern status in Minnesota) have been documented nearby.

Figure 2. Property parcels

Landscape Context

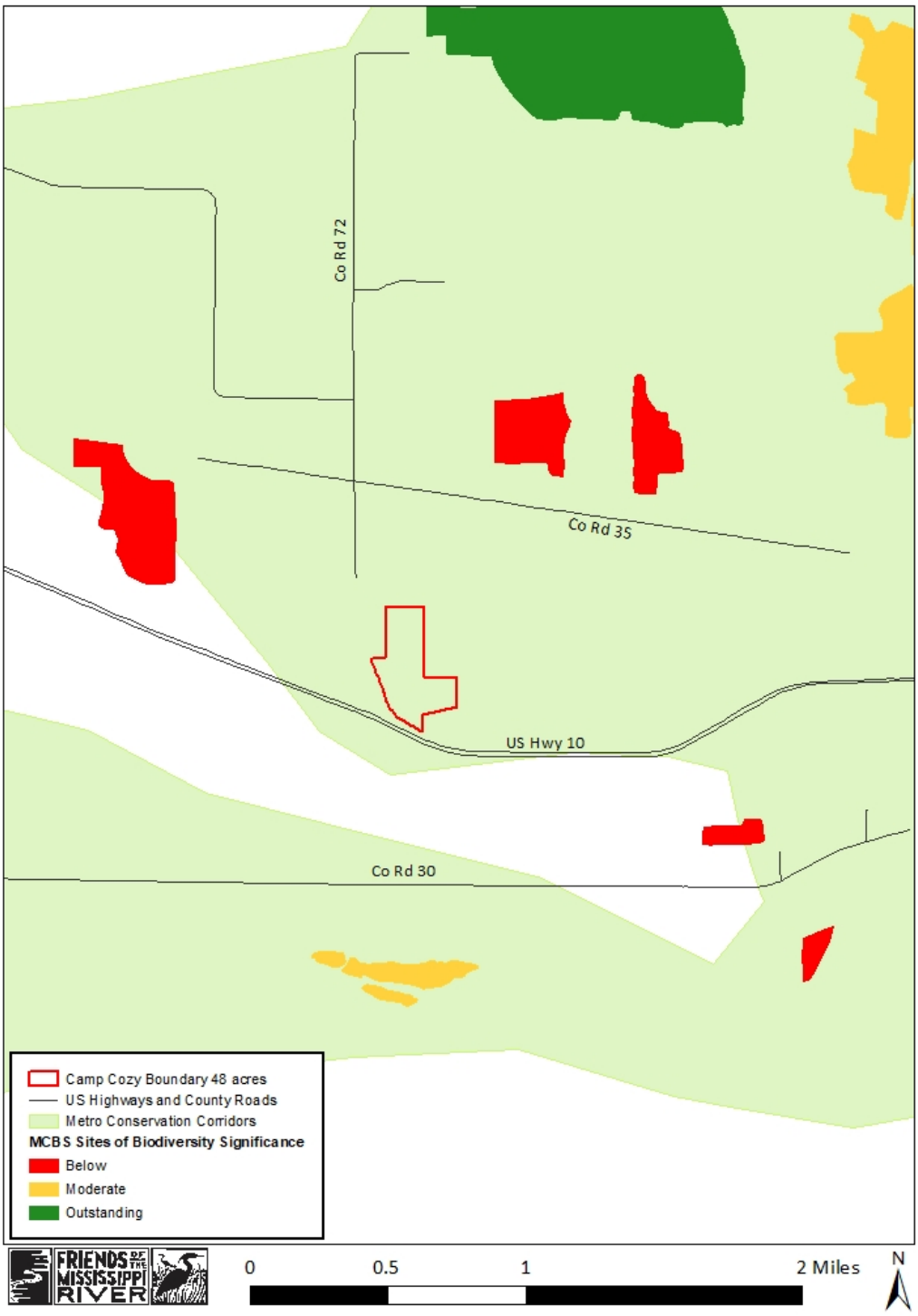
Proximity to established greenways

This property is located within the Metro Conservation Corridors (Figure 3), a regional land protection plan of the DNR. The park is also near the confluence of the Elk and Mississippi rivers and Bailey Point Nature Reserve, the William H. Houlton Conservation Area, and the Mississippi Islands SNA, a chain of seven islands formed by outwash deposited by the Mississippi river designated as a Scientific and Natural Area by the MN DNR.

Ecological significance and wildlife value

The property, although not ranked by the Minnesota County Biological Survey as biologically significant, is situated near areas ranked as having ecological significance by the MCBS, including the Mississippi River Islands SNA and floodplain forest along the Elk River within the William H. Houlton Conservation Area, just downstream. Camp Cozy's floodplain of the Elk River has inherent wildlife significance. All forms of wildlife depend on rivers for sustenance, especially invertebrates, amphibians, reptiles, and fish. Mammals and birds also benefit greatly from the water, shelter and nutrients provided by the river, and birds use the river corridor as an important migratory flyway.

Figure 3. Landscape context



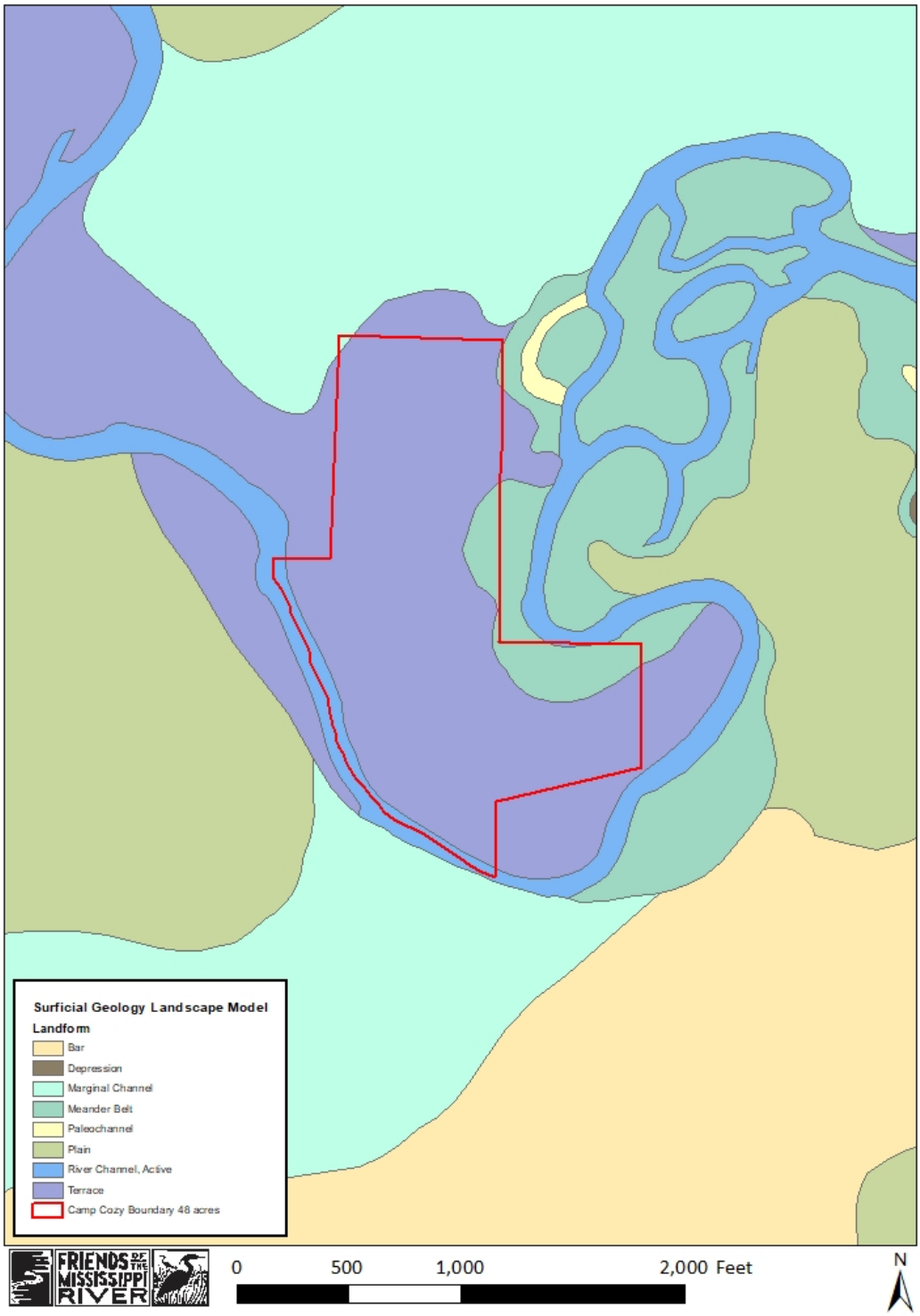
Site Geology and Groundwater

The surficial geology consists primarily of terraces – areas that were once the river channel or floodplains carved by the torrential flow of the Glacial River Warren in the Pleistocene epoch. These occur above current floodplain areas but below nearby meander channel areas. The property itself is located within the Mississippi Sand Plain (Figure 4).

These terraces are principally sand, gravel, and some finer materials, especially along the Mississippi and its smaller tributaries (Hobbs and Goebel 1982). In and around Camp Cozy, the depth from surface to bedrock is roughly 200 feet (Olsen and Mossler 1982).

Throughout the site, the depth to groundwater is consistently 0-10 feet, which is quite shallow. Groundwater flows to the south/southeast across the site, generally in the direction of the Elk River.

Figure 4. Modeled surficial geology



Topography and Soils

TOPOGRAPHY

The site has a generally flat topography with its highest points at the north-central area of the park and an overall slope to the south and southeast, or towards the direction of the Elk River (Figure 5). On a smaller scale, the land slopes slightly toward the river to the south and east with significant depression at the center of the site where old hand-dug channels persist. The most varied topography occurs on the eastern leg of the site where the terrace forest exists (Figure 6). The landscape in this area is low-lying with small islands interspersed. The slope across the site ranges from 0 to 6%. Elevation of the site ranges from a low of 874 feet above sea level to a high of 886 feet.

Figure 5. Site topography

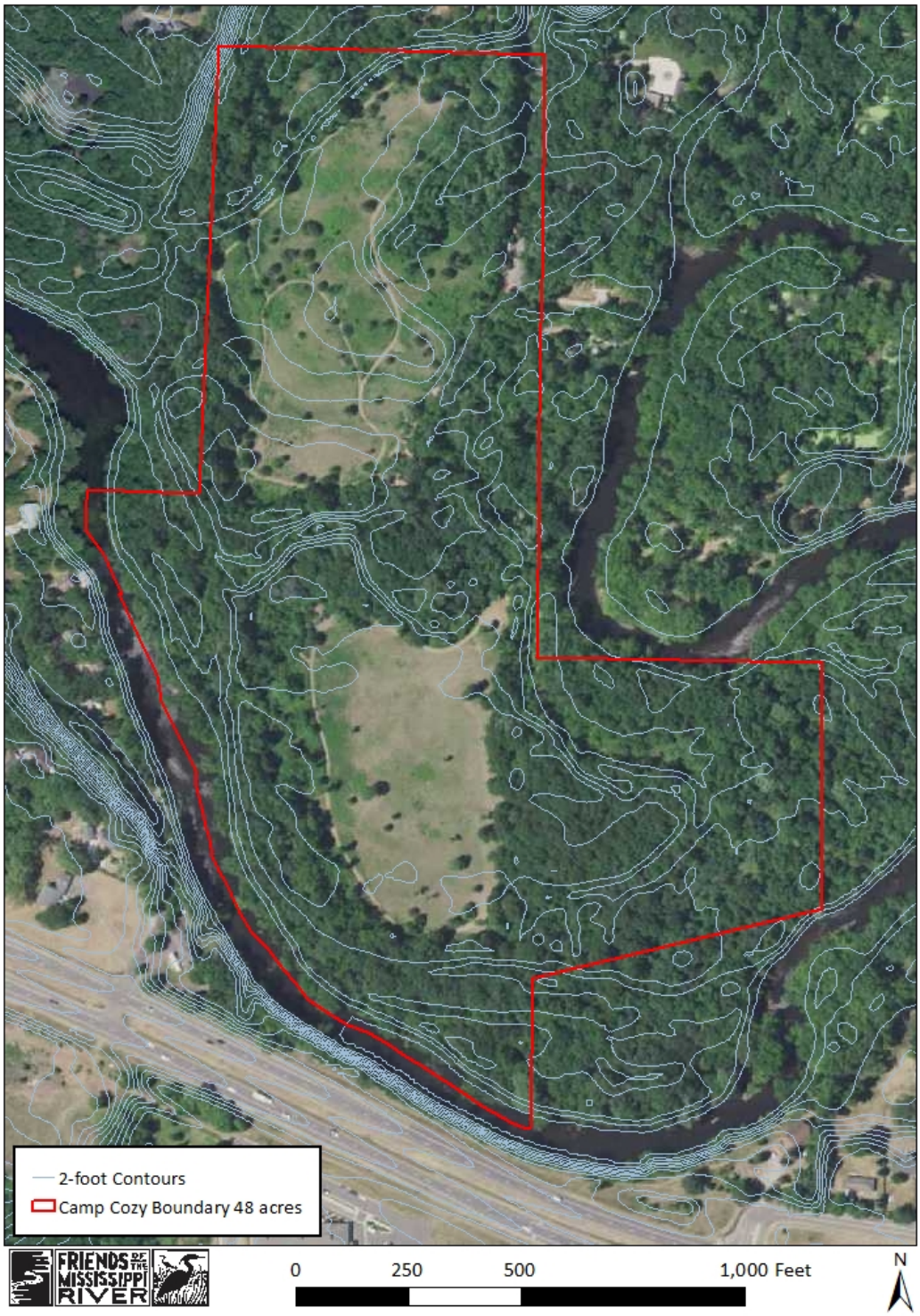
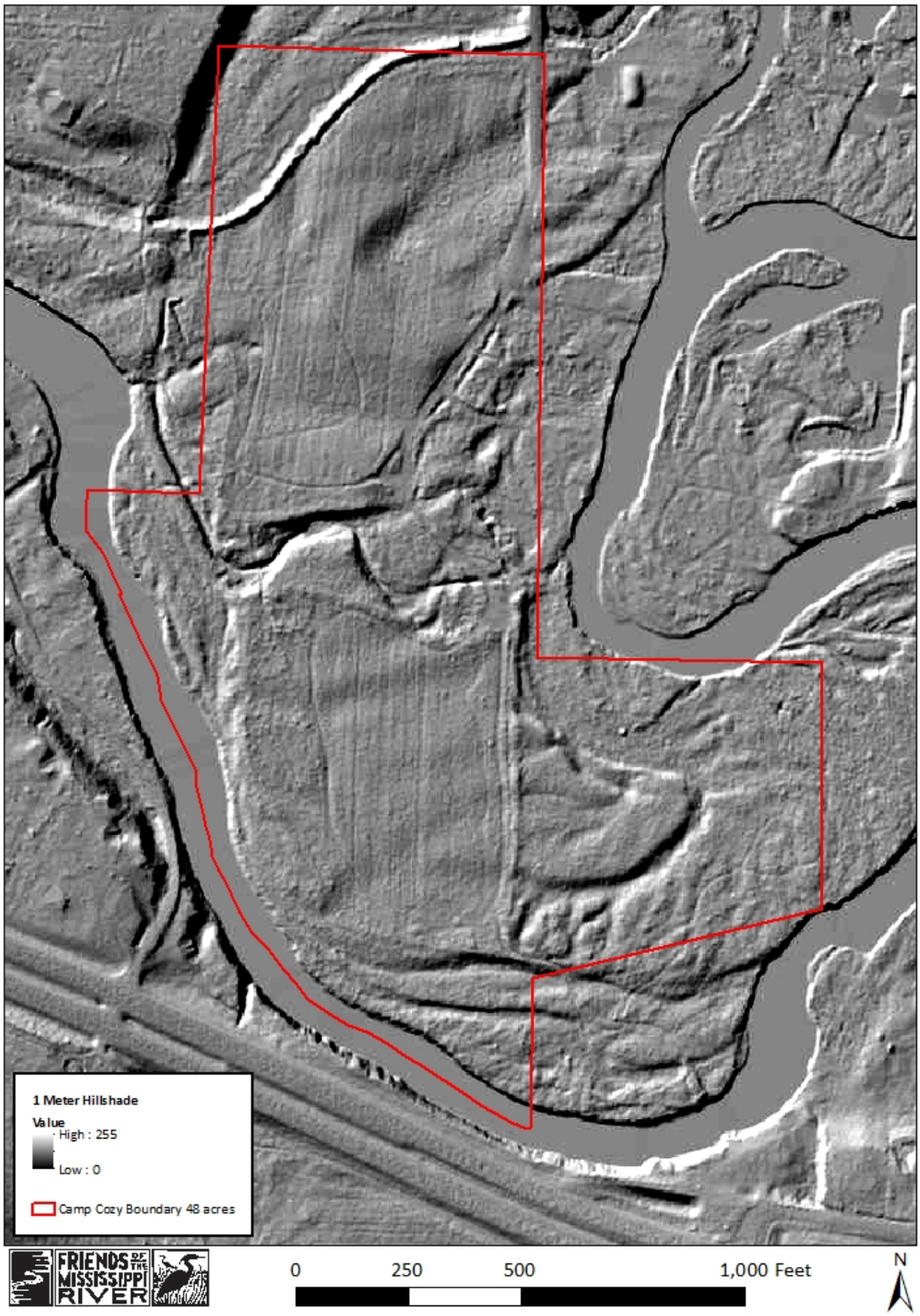


Figure 6. Site aspect



SOILS

Soils vary slightly across the site and are most influenced by interaction with the Elk River. Four specific soil types are present with three of those types attributed to the Elkriver soil series. This series consists of very deep, somewhat poorly and moderately well drained soils that formed in postglacial alluvium consisting of a coarse-loamy mantle and underlying sandy sediments on flood plains. These soils have moderate and moderately rapid permeability in the upper part and rapid permeability in the underlying material. The northwestern forest, northern prairie, southern forest and southern remnant prairie have these fine, sandy loams that are rarely flooded. The eastern and central forest areas that extend to the park's southern floodplain have fine sandy loams that are occasionally flooded. The floodplain terrace has a more unique soil complex made up of both very poorly drained and poorly drained soils with sandy particle sizes.

A summary of soils and their associated characteristics is listed in Table 1 and can be visualized in Figure 7.

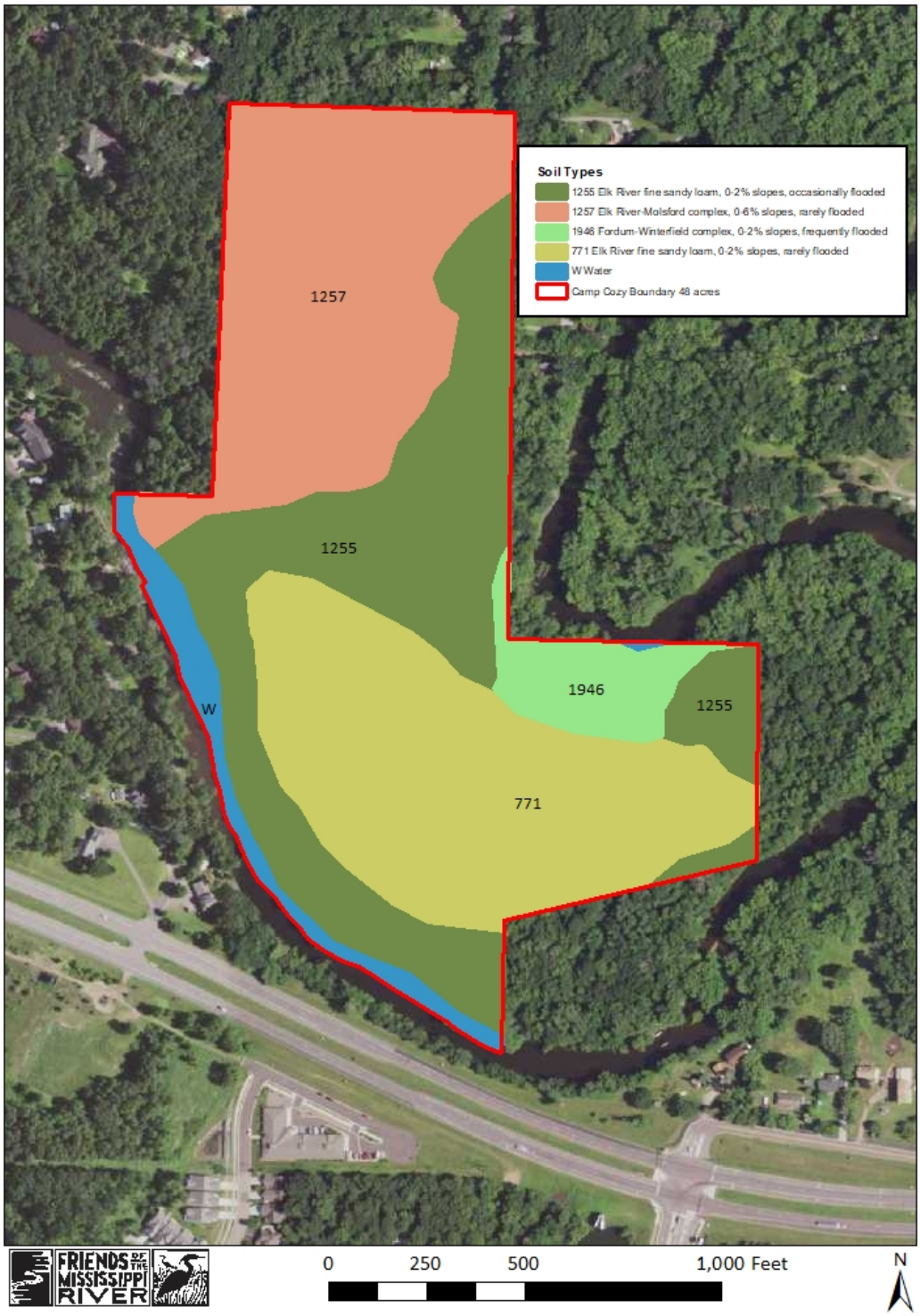
Soil formation is the result of the interaction of five soil-forming factors: parent material, climate, organisms, topographic position or slope, and time (Foth 1990). Taken collectively, these factors can help determine the dominant floral and faunal communities that helped form the soils. The predominant soil types which fall into the Elkriver series are all sandy loams which are well-suited to cultivation, and in fact, almost all areas of Elkriver soils are cropped with corn soybeans, and small grains with small areas of native vegetation in prairie grasses. These soils would have been dominated by graminoid vegetation (prairie or savanna) prior to European colonization. Due to the fine, sandy nature of some of the soils, the erosion potential is mostly medium; none of the soil types present have a high erosion potential, though all types are susceptible to some erosion by wind, water, or both.

Table 1. Soils

Soil Code	Soil Name	Percent Slope	Acres	Soil Family	Hydric (yes or no)	Drainage
771	Elkriver fine sandy loam, rarely flooded	0 to 2	15.1	Coarse-loamy, mixed, superactive, frigid Cumulic Hapludolls	N	Moderately well drained
1255	Elk River fine sandy loam	0 to 2	14.5	Coarse-loamy, mixed, superactive, frigid Cumulic Hapludolls	N	Somewhat poorly to moderately well-drained
1257	Elk River-Molsford complex	0 to 6	14.2	Coarse-loamy, mixed, superactive, frigid Cumulic Hapludolls	N	Moderately well-drained

Soil Code	Soil Name	Percent Slope	Acres	Soil Family	Hydric (yes or no)	Drainage
1946	Fordum-Winterfield complex	0 to 2	2.5	Coarse-loamy, mixed, superactive, nonacid, frigid Mollic Fluvaquents and Aquic Udipsamments	N	Somewhat poorly to poorly drained
W	Water	0	2.0	NA	Y	NA

Figure 7: Soils



Rare Species

According to the DNR natural heritage database, there are no rare species recorded within the Camp Cozy Nature Preserve. However, twelve rare species have been recorded within five miles of the site: However, twelve rare species have been recorded within five miles of the site; 1 reptile (Blanding's turtle), 2 birds (the loggerhead shrike and lark sparrow), 3 mammals (the Northern long-eared bat, plains pocket mouse, and prairie vole), 3 plants (butternut, creeping juniper, and seaside three-awn), 2 insects (the uncas skipper and rusty patched bumble bee), and 1 mussel (*Ligumia recta*, the black sandshell mussel). This mussel is a species of special concern in Minnesota and has been recorded in the Mississippi River 0.5 miles from Camp Cozy.

Habitat loss and degradation have been primary drivers of decline for species of greatest conservation need (SGCN) in the subsection, especially species associated with prairie and oak savanna. The two remnant dry prairies on the property are potential habitat for numerous rare species, including the prairie vole, rusty patched bumble bee, uncas skipper, and seaside three-awn. The property's location along the Elk River near the confluence of the Elk and Mississippi rivers also makes it an important potential habitat for myriad plant and animal species, including the rare black sandshell mussel.

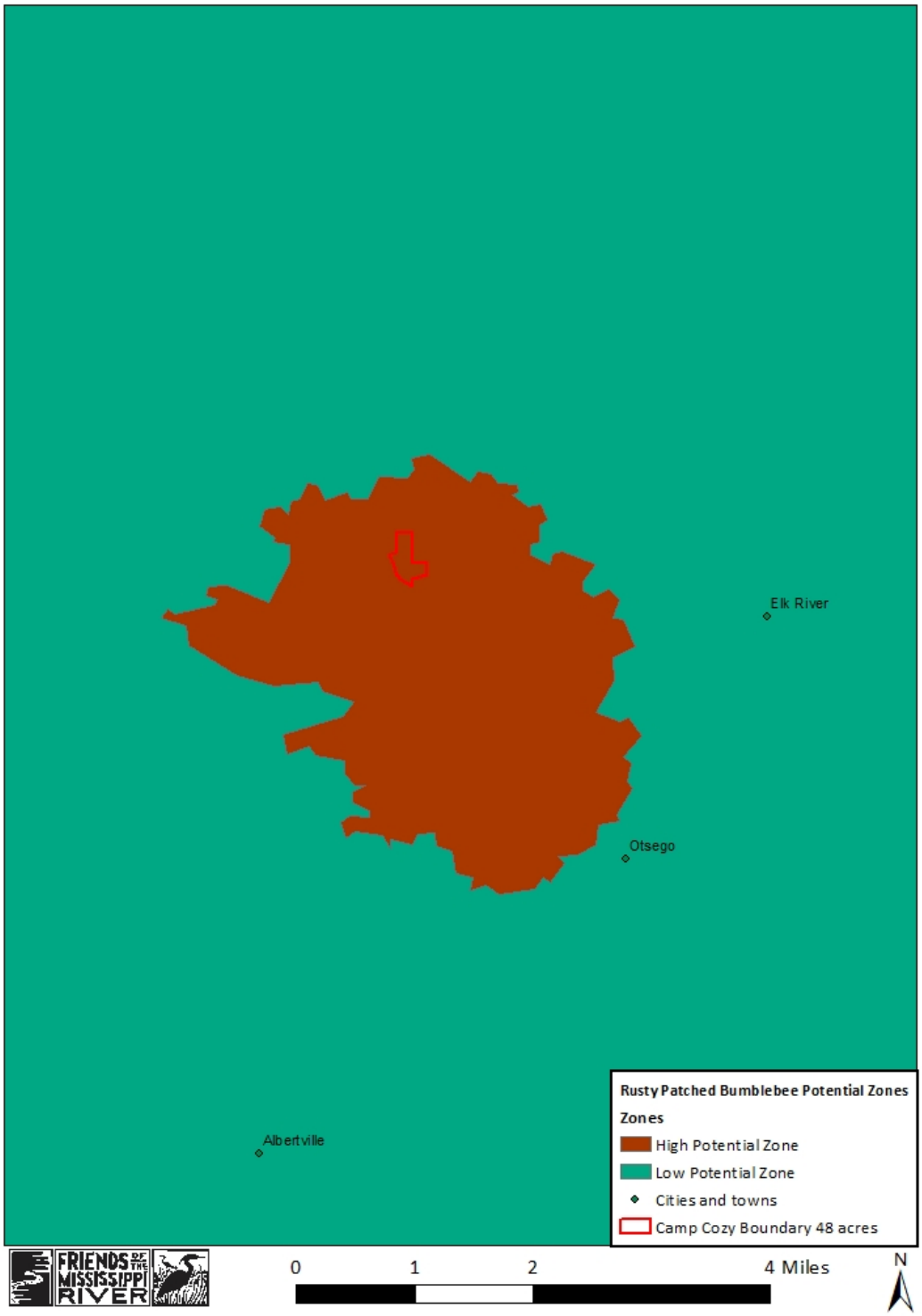
Existing Wildlife Populations

As stated, there are no rare species occurrences recorded on the property. However, a rare mussel species and a rare turtle species were found in the Elk River to the east of the property. It is possible that this species and others are present throughout this reach of the Elk River, which joins with the Mississippi a few miles downstream.

Although no longer a rare species, bald eagles remain on the DNR watch list and are frequently seen flying above Camp Cozy. Many eagles have been seen flying along the river and across the property (there is a nearby nest at Bailey Point).

Camp Cozy Park is also within a "High Potential Zone" for the Rusty patched bumblebee, a federally endangered species (Figure 8). These zones are based on a US Fish and Wildlife Service habitat connectivity model that estimates the likely distance of movement from known records of Rusty patched bumblebees within suitable habitat derived from National Land Cover Database maps. The zones suggest areas with the highest potential for the species to be present based on typical foraging distances and suitable habitat.

Figure 8: Rusty patched bumblebee potential zones



Other wildlife seen regularly include white-tailed deer, red-tailed hawks, northern harriers, American goldfinch, wood thrush, mallards, wood ducks, great blue herons, gray squirrels, red squirrels, evidence of coyotes, and numerous insects, including honeybees, bumblebees, and numerous butterflies and moths. There is also evidence of beaver activity on the property. Stumps left by beavers are visible throughout the floodplain forest, though most if not all seem to be old and were not felled in the last one or two years.

Historical Vegetation

Public land survey (PLS) records compiled by Francis J. Marschner in the 1850s identified the dominant tree (bearing tree) and recorded vegetation at every one-mile interval. Based on these notes, the landcover type in this region was mosaic of different habitats ranging from oak openings and floodplain forests to prairie, big woods forests, and aspen-oak woodlands. The boundaries of Camp Cozy Park lie within what would have been oak openings and barrens prior to European colonization (Figure 9). This was the most common land cover type of the region, and today these plant communities are known as oak savannas. Savanna is an area of scattered trees, primarily bur oak, with areas of open prairie between them. Prairie is dominated by mixed height grasses and forbs (wild flowers), with patches of shrubs and very few to no trees. The key differences between prairie and savanna plant communities are tied to frequency and intensity of fire. Generally, frequent fire (every 2 to 5 years) will result in prairie, while slightly less frequent fire (3 to 8 years) will result in savanna.

Today, the riparian areas long the Elk River are mostly forested, but it is unlikely that trees lined the entirety of the river channel 200 years ago. While much of the current floodplain forest areas were likely floodplain forest in pre-settlement times, areas of the river were more likely lined with savanna or prairie vegetation. Prairie and savanna grasses would have grown right up to the channel, perhaps forming lips over the banks, and stabilizing the bank slopes, as currently occurs in the terrace forest areas on the east side of the park where sedges and other moisture-tolerant species form hummocks and retain soil during times of flooding.

Bearing trees were noted by the 1850s PLS surveyors to help identify each section of land. If no trees were in the section, that was also noted. One bearing tree was recorded within the Camp Cozy boundary: a bur oak both on the western boundary of the site in the forest between the Elk River and the north prairie. The occurrence of bur oak here provides further evidence that this area was likely a mix of prairie and oak savanna vegetation. The soils data and the historical vegetation data concur with this determination; the soils are typical prairie soils and pre-settlement vegetation shows prairie and savanna land cover.

Historical aerial photos, Figures 10-13, also provide clues to the vegetation communities within the last century, and photos of the Camp Cozy area dating back to 1938, 1953, and 1957 shed light on past conditions. In 1938, the present-day prairies appear entirely open and grassy with only sporadic trees. Present-day forest surrounding the prairies appear to have widely spaced

trees and an herbaceous understory indicative of savanna conditions. Many of the floodplain forest areas had a sparser canopy and looked similar in structure to vegetation found in a savanna-type landscape. While a thin strip of tree cover lines most of the riverbanks, some areas were relatively open right up to the rivers' edge. Moreover, in what is now some of the larger floodplain areas, it is easy to see the more open nature of the habitat, with trees interspersed with more open grassy areas. Over the last 70 years, fires have been suppressed in the United States, and as a result, open, grass-dominated plant communities have been encroached by pioneering woody species, and that has been the case at Camp Cozy where the prairies and former oak savannas have decreased in extent over the last 80 years.

Figure 9: Historic vegetation communities

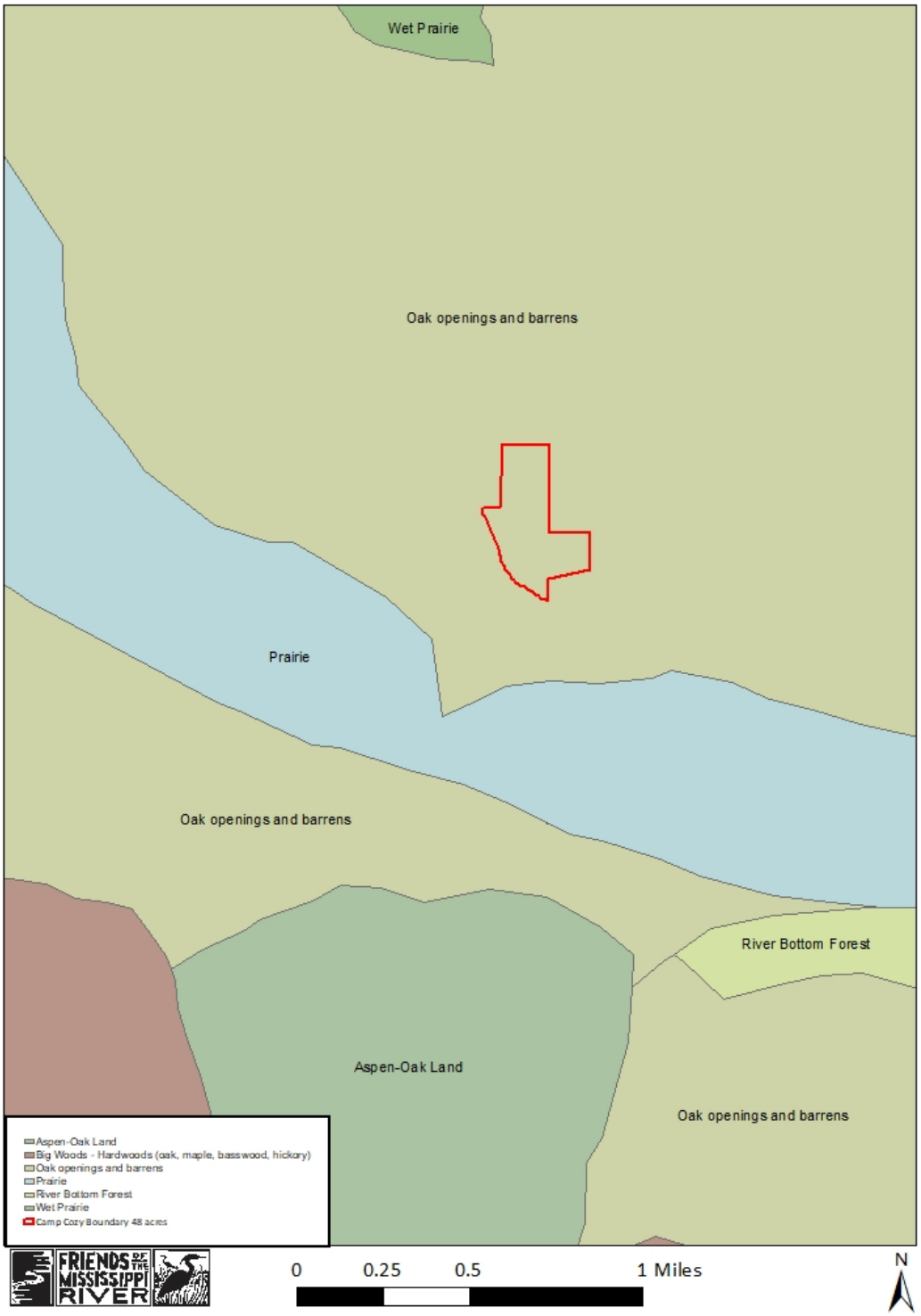


Figure 10. 1938 Aerial photo

Figure 11. 1953 Aerial photo

Figure 12. 1957 Aerial photo

Historical and Existing Land Use

Records of historical land use are lacking, but some evidence exists that this site may have been used in prior to European colonization. Aside from the site's obvious importance on a major river, the site is located in proximity to a number of other sites where evidence of Indigenous activity was found. Quartz flakes and projectile points have been found in and around Elk River.

In the 1938 aerial photos, agricultural fields dominated the landscape around the site, and many farms occurred where they do not today. For example, the agricultural fields east of the property are now in residential use. North and east of the property, the city of Elk River looked much as it does today, though with fewer houses and other structures. The major streets throughout the area, including Highway 10, were all present in 1938. New road construction occurred when developing the neighborhoods to the east. By 1953, a number of houses were beginning to be constructed east of the property, with accelerated development occurring between the 1957 and 2003. The aerial photo from 2010 (Figure 13) shows a dramatic increase in residential housing having replaced the agricultural fields.

Figure 13. 2010 Aerial photo

In the immediate area of the property, the river channels do not seem to have been artificially altered, though the river has lost many of its small, braided channels. Many of these have become filled with sediment over time and vegetated with floodplain tree species. Comparing

the 1938 and 2010 aerial photos, the water level was much lower in the 1930s, creating a number of smaller islands. As previously noted, the land of Camp Cozy was previous used as a resort with “flues” dug to divert flows from the river into the resort property to form a paddling circuit. These channels have persisted over the last 90 years. Some of the flues have slightly eroded into gullies and have also been an area of dumping over time.

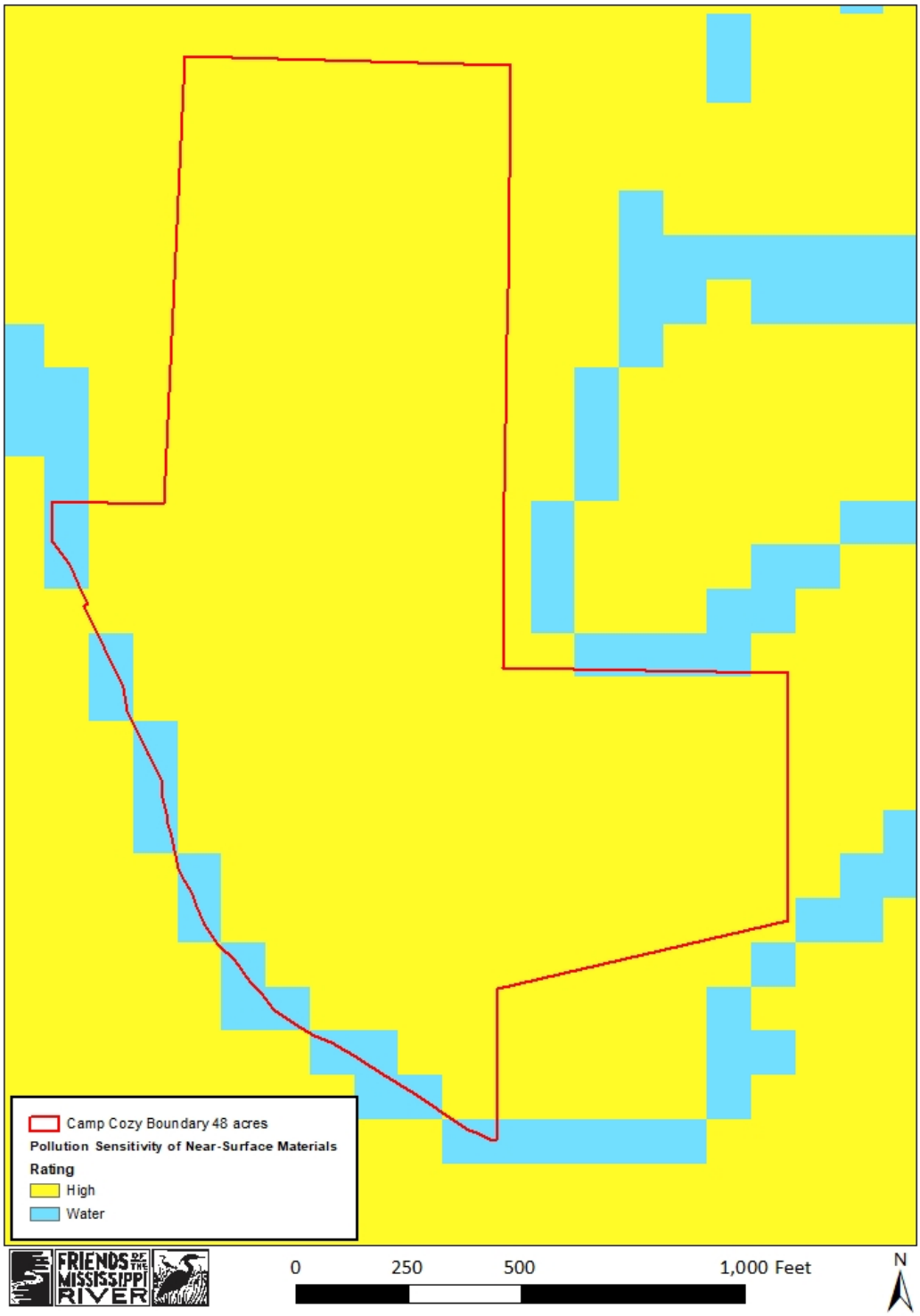
Many land use changes have occurred on the site over the last century. Several buildings were present in the 1930s, vestiges of the Camp Cozy resort of the 1920s. These buildings were later repurposed into a dance hall, roller rink, diner, and bar that served the community into the 1930s. A bridge connected Camp Cozy to US Highway 10 to the south until the late 1950s, and the resort structures remained on the property until this time when portions of the resort burned, and the remainder was sold. It does not appear that the land was in agricultural production during the last century, and the property sat vacant for many years until it was donated to the city of Elk River in 1996 and a nature park was established.

Water Resources

A compilation of information related to the surface water resources at Camp Cozy and associated issues such as erosion, impairments and groundwater infiltration is noted below.

The water table elevation at the property is 860-880 feet above sea level (FASL). With site elevations ranging from 874 to 886 FASL, the depth to water table is quite shallow at 0-10 feet. Extra care should be taken when using herbicides, fuels and other potential pollutants, given this shallow depth to water table and the highly permeable sandy soils throughout much of the site where management is planned. The entirety of the property is considered to be highly sensitive to pollution due to its geology and depth to groundwater, as shown in Figure 14.

Figure 14. Pollution sensitivity of near-surface materials



Surface Waters – Rivers

The Elk and Mississippi rivers are the obvious surface water resources in this area. The Orono Dam controls maintains water elevations in this lower stretch of the Elk River. Following large rain events, and especially in the spring with snowmelt, flows can be quite high, and the well-connected floodplain clearly receives flood flows. The southeast edge of the property, where floodplain forest is present, experienced extensive and prolonged flooding in 2023. The banks along the western edge of the property are relatively higher and bordered by transitional terrace forest, which leads to infrequent flooding.

Impairments

Based on 2022 sampling by the Minnesota Pollution Control Agency, the Elk River is impaired for both *E. coli* and mercury in fish tissues in the river reach from the St. Francis River to Orono Lake just downstream from Camp Cozy. The *E. coli* impairment has been recognized since 2012 and is related to agricultural runoff from farm fields and pasture areas upstream. The mercury impairment in this reach has been recognized since 2002. Both impairments require a study to determine the Total Maximum Daily Load (TMDL), or the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards.

Floodplain

In 1965, an historic flood occurred throughout the state of Minnesota. The city of Elk River suspended classes so that students could help sandbag local establishments and other key areas of the city. Today, 24 acres of the property's 48 acres lie within the floodway or have a 1% chance of annual flooding. The floodplain within the park not only provides exceptional habitat in a matrix of other habitat types, but also offers a significant location for flood storage. As rapid development in the western portion of the city creates additional impervious surfaces, and climate change increases heavy rainstorms and rapid spring melt, floodplains and wetlands are a valuable resource to protect infrastructure, homes and businesses.

Erosion

Historically, erosion has not been a problem on the property. As flashy river flows increase with greater impervious surfaces and a changing climate, the small channels throughout the south-central portion of the park will receive increased flow. These "flues" should be monitored in early summer to determine if downcutting or bank erosion is occurring. Because of light herbaceous vegetation in these areas, future restoration efforts could focus on replanting both herbaceous and woody native plants in these areas to stabilize the channel banks and prevent soil loss.

Buffer Areas

The floodplain and terrace forests surrounding the property act as natural buffers for the waterways, and these wetlands also buffer the river from activities in the upland areas. Future park improvements must be designed so that these buffers are protected from degradation, and plans must comply with local wetland protection rules regarding the increase of impervious surfaces and the location of trails within wetland buffers.

Stormwater Management Issues

The property is not highly affected by runoff from adjacent properties. Most runoff from adjacent land use flows into the Elk River before it can reach Camp Cozy. Natural flooding of the floodplain and terrace forest within the property can and does occur. However, there are also residential properties north and east of the park that supply some runoff to the site. These properties are mostly located at a similar elevation to the park, but runoff from roads and driveways could conceivably flow onto the property. It could be conceived that these vintage properties might be redeveloped in the future given their proximity to the river. As such, stormwater runoff if impervious surfaces increase on these parcels, will impact Camp Cozy.

The paving of some trails with Camp Cozy has been contemplated by Elk River Parks and Recreation staff. If trails were paved, these impervious surfaces would decrease infiltration within the site.

Wetlands

According to the National Wetland Inventory (NWI) Cowardin Classification of the property, Camp Cozy contains predominantly freshwater forested wetland (20.1 acres) which is connected to a 54-acre hardwood floodplain along the Elk River. This floodplain is bounded by a riverine, non-vegetated aquatic community (Open Water), where the Elk River flows (Figure 15).

Figure 15: Wetlands

Adjacent Land Use

Land use around Camp Cozy is dominated by residential development, industrial and agricultural use (Figure 1). The Elk River borders the property to the south and east, and urban land use is present to the north, south, and east beyond the river's corridor. This means that urban and residential runoff, agricultural nutrient loading, pollutants, and warm water from streets, roads, parking lots, and buildings all affect these waters before they arrive at the site. This part of Elk River lies within the Urban Services Area, meaning that city-operated infrastructure will continue to be built to serve expansion in development within this part of the city. Because many of the homes within the neighborhood bordering Camp Cozy are aged, redevelopment of these properties, especially those along the Elk River, is likely. East of the property, the Elk and Mississippi Rivers combine and turn southward, flowing southeast through a more urban landscape and eventually reaching the Twin Cities metro area.

EXISTING LAND COVER & ECOLOGICAL MANAGEMENT RECOMMENDATIONS

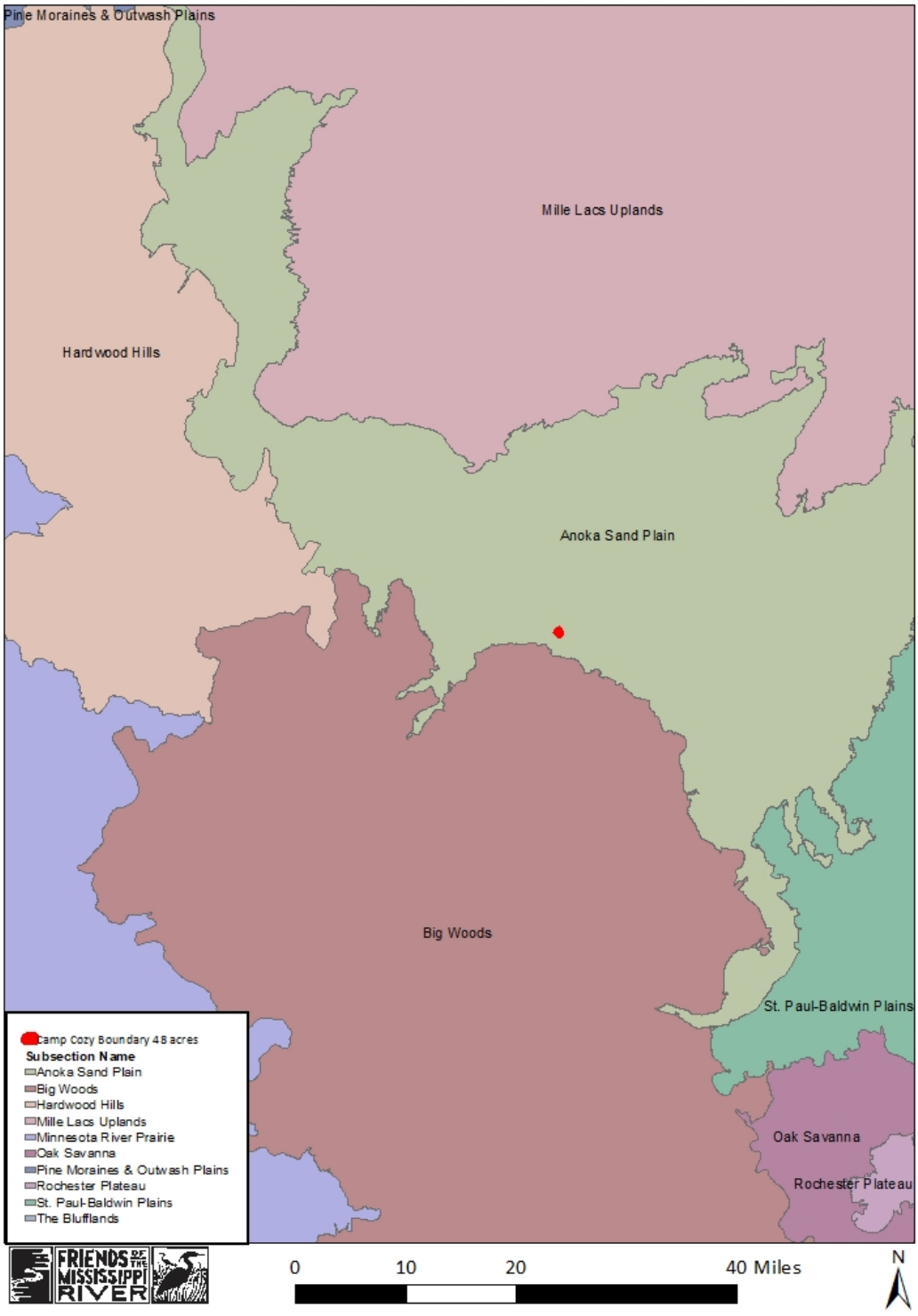
To better understand the property's existing land cover in 2023, FMR ecologists used the Department of Natural Resources (DNR) Minnesota Land Cover Classification System (MLCCS), which integrates cultural and vegetation features of the landscape into one comprehensive land classification system.

To determine target plant communities for restoration (Table 2), we considered the following: 1) historic conditions, 2) existing conditions, 3) relative effort versus benefits, and 4) the desires of the City of Elk River. Relative effort versus benefit simply means that if the amount of energy and work that needs to go into restoring a particular community is too great, in terms of the benefits received, then restoration would not be recommended. This helps to determine the optimal and most suitable goals for restoration. Target communities are in accordance with the *Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province* (DNR, 2005) and are described below.

The field guides of native plant communities describe the system developed by the Minnesota Department of Natural Resources for identifying ecological systems and native plant community types in the state based on multiple ecological features such as major climate zones, origin of glacial deposit, and plant composition. There are four ecological provinces in Minnesota (prairie parkland, eastern broadleaf forest, Laurentian mixed forest, and tallgrass aspen parkland), ten sections within the provinces, and 26 subsections. Camp Cozy is classified as follows (Figure 15):

Ecological Province: *Eastern Broadleaf Forest*
Section: *Minnesota and Northeast Iowa Morainal*
Subsection: *Anoka Sand Plain*

Figure 15. Ecological subsections of southeast Minnesota



As previously noted, the historical vegetation of Camp Cozy was most likely a mix of floodplain forest near the Elk River and oak savanna and prairie in the uplands. These plant communities

remain appropriate targets for restoration within most of the site, but there has been some community succession. Some areas that had likely been prairie and savanna have succeeded to overgrown forest and savanna, and the relative cost-benefit of restoring historical plant communities should be weighed. Additionally, restoration planning must also consider that Camp Cozy's intended use is as a nature park, and certain areas of the site that have been maintained as mowed turf should be carved out of restoration management units to provide for areas of park programming and the construction of amenities. The size of the park at nearly 50 acres allows for a good balance of developed space that serves the community, opportunities for unique interactions with the river, prairies, and forests, and the preservation of imperiled habitat.

PLANT COMMUNITY ASSESSMENT

Land Cover

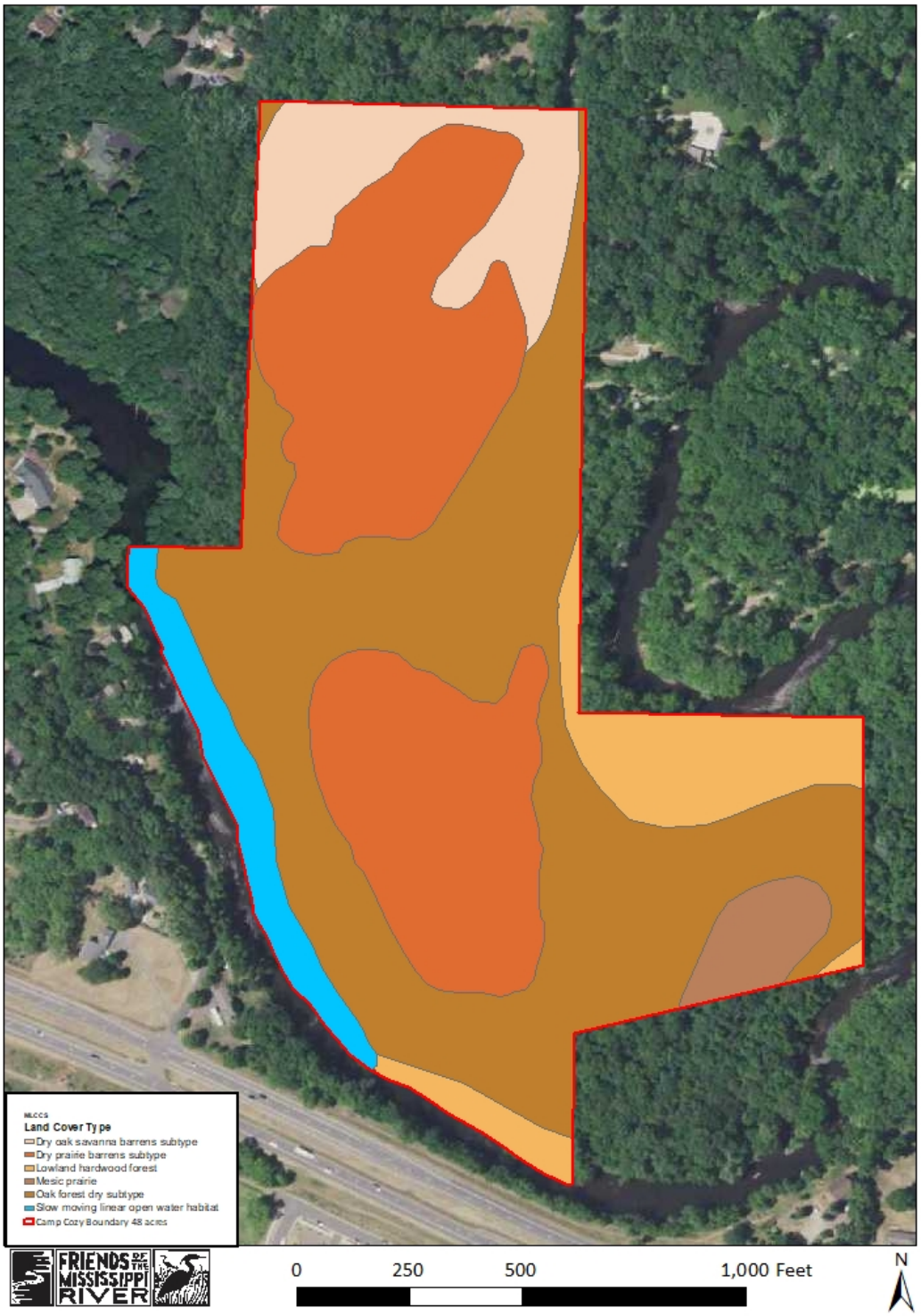
The MLCCS consists of five hierarchical levels that are reflected in a five-digit classification code. At the most general level, land cover is divided into either Natural/Semi-Natural cover types or cultural cover types. The cultural classification system is designed to identify developed areas impervious to water and vegetation patterns.

Level 1 - General growth patterns (e.g. forest, woodland, shrubland, etc.)
Level 2 - Plant types (e.g. deciduous, coniferous, grasslands, forbs, etc.)
Level 3 - Soil hydrology (e.g. upland, seasonally flooded, saturated, etc.)
Levels 4 & 5 - Plant species composition, (e.g. floodplain forest, fen sedge, jack pine barrens, etc.)

The current MLCCS land cover of Camp Cozy Park is a mix of predominantly upland land covers: "Dry oak savanna barrens" in the north, "Dry prairie barrens in the areas of the two remnant prairies, "Oak forest" within the oak forests, and "Lowland hardwood forest" in the terrace and floodplain areas (Figure 17). Additionally, two acres of mesic prairie is shown in the area of the southern mesic prairie remnants, though these remnants are considerably smaller due to woody encroachment. With some nuance, these land cover classifications are accurate.

Each unit description includes a recommended plant community which can be used to guide restoration, based on the Minnesota DNR Native Plant Communities. Full descriptions of each native plant community recommended for the property can be found in Appendix B.

Figure 17: Existing MLCCS landcover



Site Description & Recommended Plant Communities

A natural resources inventory and assessment was conducted by FMR ecologists during the summer of 2023 to ground-truth the MLCCS data and document existing plant and wildlife communities, identify opportunities for restoration and develop guidance for long-term public use. Based on this assessment, ecologists identified five primary vegetation cover types: remnant dry prairie, oak forest, mixed deciduous forest, terrace forest, and floodplain forest. These cover types occur in eight distinct units across the park, and vegetation for each unit is documented in Appendix A.

Camp Cozy Park can be described as a dry prairie and oak savanna complex surrounded by oak forest and bordered by floodplain forest and terrace forest near the Elk River.

In the oak forest areas, the tree canopy is dominated by white and red oak, but native species common in secondary growth forests including box elder, green ash, black walnut, silver maple, and northern pin oak are also common. Emerald ash borer infects a number of ash trees in the forested and woodland areas, and this will cause a significant shift in the forest's canopy over the next several years. Additionally, the lack of a soil organic layer signifies that the forests are affected by non-native earthworms. Invasive earthworms, through rapid consumption of organic material in the soil profile, are contributing to both soil loss and the absence of conditions that would otherwise support a more abundant and diverse herbaceous plant community. Many native species are present in the herbaceous layer of the oak forest, but there is a lack of abundance, cover and species diversity. The shrub layer in a few distinct areas is dominated by nonnative and invasive common buckthorn, but native shrubs including red elderberry, red-osier and gray dogwood are present.

Three distinct mesic prairie remnants have persisted in the oak forest. Each is only 0.1 - 0.2 acre and surrounded by dense forest, but species such as leadplant, common harebell, culver's root and prairie dropseed are in abundance.

A high degree of species diversity is found in the remnant dry prairies, the central cores of the park. Here, the plant composition is dominated by native graminoid species typical of dry, sandy prairies such as little bluestem, needle and thread grass, and Indian grass. Forb species such as prairie spiderwort, common lupine and hoary vervain are all common. The last prescribed burn of the prairies occurred in 2003. As a result, the prairies have woody encroachment by native species such as smooth sumac, eastern red cedar, and quaking aspen. Despite the woody cover, native prairie species persist under the shrub layer. Both prairies are encircled by wide mowed paths, and the north prairie has several internal mowed paths with trail connections to the forested areas.

The terrace forest and floodplain forest are only separated by 1-2 feet of elevation, and flood flows from the Elk River reach both units and affect the plant communities similarly. The terrace forest is dominated by moisture-tolerant, nutrient- and shade-loving species such as blueflag iris, fowl manna grass, rice-cut grass, sensitive fern and smartweeds. A variety of

sedges are also present such as hop, retrorse, and awl-fruited sedges. The groundlayer also includes a carpet of tree seedlings from green ash and hackberry germinating in moist, nutrient-rich soils. The shrub layer contains a few native species, but common buckthorn is the dominant species in this guild. The tree canopy is approximately 75% closed with some gaps resulting from fallen willow, cottonwood and silver maple, and it is within these gaps where herbaceous vegetation is most dense.

The floodplain forest exhibits a similar species composition to the terrace forest with slightly less diversity. Many species typical of Minnesota floodplains are present: broad-leaf arrowhead, sensitive fern, scouring rush, wild geranium and riverbank grape. Because this area experiences frequent flooding, a considerable amount of trash is present within the unit. Many green ash within the terrace forest and floodplain forest have been infected with emerald ash borer, which will rapidly change the canopy composition and cover as green ash is a dominant species within this unit. Hackberry, silver maple, box elder and cottonwood are also common.

Unit 1
North Prairie

Photo 1. Butterfly-weed (*Asclepias tuberosa*), an important pollinator resource, in the Unit 1 dry prairie, June 2023.

Acres: 8.7 acres

MLCCS Land Cover types: 61211 Dry prairie barrens subtype.

General Description: Unit 1 is a remnant dry prairie that still retains a high diversity of native prairie species. No canopy is present. A shrub layer is present across much of the unit and consists primarily of smooth sumac and red cedar encroachment; common buckthorn, Siberian elm and prickly ash are also present. Big bluestem is abundant in the ground layer, and many other native grasses are also present, including little bluestem, prairie dropseed, needle and thread grass, Indiangrass, and Scribner's panic grass. Native plant diversity in this unit is high, with over 100 species recorded during vegetation surveys (Appendix A), including prairie smoke, pussytoes, lupine, pasqueflower, and large-flowered beardtongue. The invasive cool season grasses smooth brome and Kentucky bluegrass are also abundant. Poison ivy is abundant in some pockets within the prairie, and care will need to be taken to manage these areas safely. This area is specifically marked on the management unit map (Figure 19). Woody

encroachment is a primary concern in this unit. The abundance of walking trails through this unit provides fire breaks internal to the unit which would allow for refugia during prescribed burning, but the numerous trails can also increase the likelihood that invasive species will be brought to the site.

Recommended Plant Community: UPs13b Dry Sand - Gravel Prairie (Southern) (Appendix B)

Unit 2
South Prairie

Photo 2. Unit 2 dry prairie in September 2023.

Acres: 6.6 acres

MLCCS Land Cover types: 61211 Dry prairie barrens subtype.

General Description: Unit 2 is a remnant dry prairie with a plant community similar to that of Unit 1 (Appendix A). Primary differences include less woody encroachment from sumac and other woody species due in part to previous management efforts and fewer invasive cool season grasses possibly due in part to fewer walking trails and the subsequent introduction of

non-native species. Where Unit 1 has a perimeter trail and several internal trails that divide the prairie, Unit 2 has only a perimeter trail. Some poison ivy is present in this unit, but it is less abundant than in Unit 1. Woody encroachment remains a primary concern in this unit.

Recommended Plant Community: UPs13b Dry Sand - Gravel Prairie (Southern) (Appendix B)

Unit 3
Mesic Prairie Remnant (North)

Photo 3. Native prairie plants and woody encroachment in Unit 3, June 2023.

Acres: 0.2 acres

MLCCS Land Cover types: 61110 Mesic prairie.

General Description: Unit 3 is a remnant mesic prairie that is surrounded by the oak forest of Unit 5. Historically, this area was most likely much larger, grading into surrounding oak savanna. No canopy cover is present, but woody encroachment in the shrub layer is prevalent, and sumac, buckthorn and prickly ash are common. Common native species in the ground layer include porcupine grass, big bluestem, Canada goldenrod, black-eyed Susan, clammy ground

cherry and ivory sedge. The invasive hoary alyssum is common, and some mullein is present. Recorded vegetation data is documented in Appendix A. Woody encroachment is a primary concern, and, given its small size, management of this unit will need to be creative.

Recommended Plant Communities: UPs23 Southern Mesic Prairie (Appendix B).

Unit 4
Mesic Prairie Remnants (South)

Photo 4. A narrow path through mesic prairie and woody encroachment in Unit 4, June 2023.

Acres: 0.1 acres

MLCCS Land Cover types: 61110 Mesic prairie.

General Description: The remnant mesic prairies of Unit 4 are similar to Unit 3, although the plant composition indicates somewhat moister soils (Appendix A). These areas were likely connected and part of a much larger mesic prairie, subsumed by oak forest (Unit 6) over time, and MLCCS data also indicates a much larger extent of mesic prairie in this area. The remnants of Unit 4 have less woody shrub encroachment than Unit 3. Species composition is similar,

although species such as great St. John's wort, culver's root, switchgrass and figwort take the place of clammy ground cherry and ivory sedge. Unit 4 displays less disturbance with fewer invasive species present, but a deer stand near the unit indicates that this area of the park is traversed. Woody encroachment is a primary concern, and, given its small size, management of this unit will need to be creative.

Recommended Plant Community: UPs23 Southern Mesic Prairie (Appendix B).

Unit 5
North Oak Forest

Photo 5. Giant cottonwood near the northeast corner of Unit 5 oak forest, June 2023.

Acres: 5.9 acres

MLCCS Land Cover types: 62122 Dry oak savanna barrens subtype; 32113 Oak forest dry subtype.

General Description: Unit 5 is a degraded oak forest on the northernmost boundary of the park with bur oak representing the most significant element of the canopy. Basswood, pin and red

oak, cedar, willow, cottonwood and hackberry are also present. Buckthorn is present in the shrub and sub-canopy layer, along with honeysuckle, prickly ash and black cherry. Buckthorn is also common in the groundcover, along with native gooseberry, Pennsylvania sedge, and hackberry seedlings. Columbine, sweet cicely and starry false Solomon's seal are also present in the groundcover, among other native herbaceous species. Recorded vegetation data is documented in Appendix A. Although much of this unit was likely an oak savanna prior to European colonization, restoring this unit to savanna would be logistically challenging and costly, requiring the removal of many large canopy trees and a major transition of the understory plant community. A trail connecting the north prairie (Unit 1) to the road, at the northeast corner of the property, is present and appears to get some use from wildlife and human visitors.

Recommended Plant Community: MHs38b Basswood - Bur Oak - (Green Ash) Forest (Appendix B).

Unit 6
South Oak Forest

Photo 6. Sprawling bur oak canopy in Unit 6 oak forest, September 2023.

Acres: 12.0 acres

MLCCS Land Cover types: 32113 Oak forest dry subtype; 32220 Lowland hardwood forest; 61110 Mesic prairie.

General Description: Unit 6 is similar in composition to Unit 5 (Appendix A); a degraded oak forest with bur and red oak, green ash, silver maple, hackberry, and basswood in the canopy. Buckthorn is especially dense in the shrub and understory layers between the north and south dry prairies (Units 1 & 2). Other understory plants include honeysuckle, prickly ash, gray dogwood, and dames rocket. In addition to invasive buckthorn, the groundcover includes native species such as jack-in-the-pulpit, northern bedstraw, bloodroot, and horsetail. Emerald ash borer (EAB) damage is present in the unit. Two walking trails traverse Unit 6 on the northern end of the unit, and one winding walking trail moves through the unit from the eastern edge of the south prairie (Unit 2) to the eastern boundary of the park.

Recommended Plant Community: MHs38b Basswood - Bur Oak - (Green Ash) Forest (Appendix B).

Unit 7
Terrace Forest

Photo 7. Flue through the central terrace forest in Unit 7, September 2023.

Acres: 11.3 acres

MLCCS Land Cover types: 32113 Oak forest dry subtype; 32220 Lowland hardwood forest.

General Description: Unit 7 is a terrace forest extending from the southernmost point of the property, along the Ek River to the west, and in between the two dry prairies (Units 1 & 2). The canopy consists of red and white oak, silver maple, green ash, hackberry, boxelder and cottonwood. The shrub layer is dominated by buckthorn, with some red osier dogwood present. Ground layer vegetation includes wood nettle, stinging nettle, sensitive fern and jack-in-the-pulpit. Invasive garlic mustard is also present. Recorded vegetation data is documented in Appendix A. Evidence of EAB (emerald ash borer) is present along with some dead standing green ash. A narrow foot path extends from the south dry prairie (Unit 2) westward to the bank of the Elk River. There is evidence of the canals or flues built during Camp Cozy's resort days in the 1920's.

Recommended Plant Community: FFs59a Silver Maple - Green Ash - Cottonwood Terrace Forest (Appendix B).

Unit 8
Floodplain Forest

Photo 8. Vegetation growth following spring flooding of the floodplain forest in Unit 8, July 2023.

Acres: 3.4 acres

MLCCS Land Cover types: 32220 Lowland hardwood forest; 32113 Oak forest dry subtype.

General Description: Unit 8 is a floodplain forest east of the south dry prairie (Unit 2) and north of the south oak forest (Unit 6), in an oxbow of the Elk River. The canopy consists of red and white oak, silver maple, green ash, hackberry, boxelder, and cottonwood. The shrub layer consists primarily of buckthorn and red osier dogwood. Ground layer vegetation includes wood nettle, stinging nettle, sensitive fern, rice cutgrass, blueflag iris, and horsetail. Invasive garlic mustard is present. Recorded vegetation data is documented in Appendix A. Evidence of EAB (emerald ash borer) is present along with some dead green ash. There is evidence of regular flooding throughout the unit. Along the north and east boundaries of the unit, significant debris

has accumulated along the ground, including tarps and pieces of wood structures, likely deer stands.

Recommended Plant Community: FFs68 Southern Floodplain Forest (Appendix B).

Unit 9
Mowed Area

Photo 9. Unit 9 is a large, mowed area to the northeast of the southern dry prairie in Unit 2, July 2023.

Acres: 0.1 acres

MLCCS Land Cover types: 61211 Dry prairie barrens subtype; 32113 Oak forest dry subtype.

General Description: Unit 9 is a large, mowed area in the northeast corner of the south prairie. The south perimeter trail runs through it, and it is also connected to several mowed areas providing access to neighboring private properties. Reducing the mowed area so that it is wide enough to accommodate walkers and desired city access but no wider would provide an opportunity to reclaim some of the area for the south prairie (Unit 2), which has shrunk by several acres over the past 20 years.

Alternatively, this area could be maintained as a mowed space for future park programming. The unit's proximity to the river (440 feet), access to the roadway (380 feet), level terrain and openness lend itself to a picnic area or park shelter. If park master planning in 2025 identifies development of this space as a priority, this area should not be included in restoration of the nearby dry prairie in Unit 2.

Recommended Plant Community: None; UPs13b Dry Sand - Gravel Prairie (Southern).

RESTORATION

This section describes the proposed restoration process for Camp Cozy Park and includes information on target plant communities and habitat goals to be achieved through restoration (Figure 18). A description of the restoration process and the goals for the restoration, both broad and specific, are also provided.

Elk River Parks and Recreation staff note the desire to invest state grant restoration funding only in areas of the park not intended for future programming or building site improvements (picnic shelter, canoe launch, paved trails). Potential improvements will be specified in an Elk River Parks master plan in 2025, and areas best suited for site programming are noted in the management unit descriptions below.

Target Plant Communities

Figure 18. Recommended/target plant communities

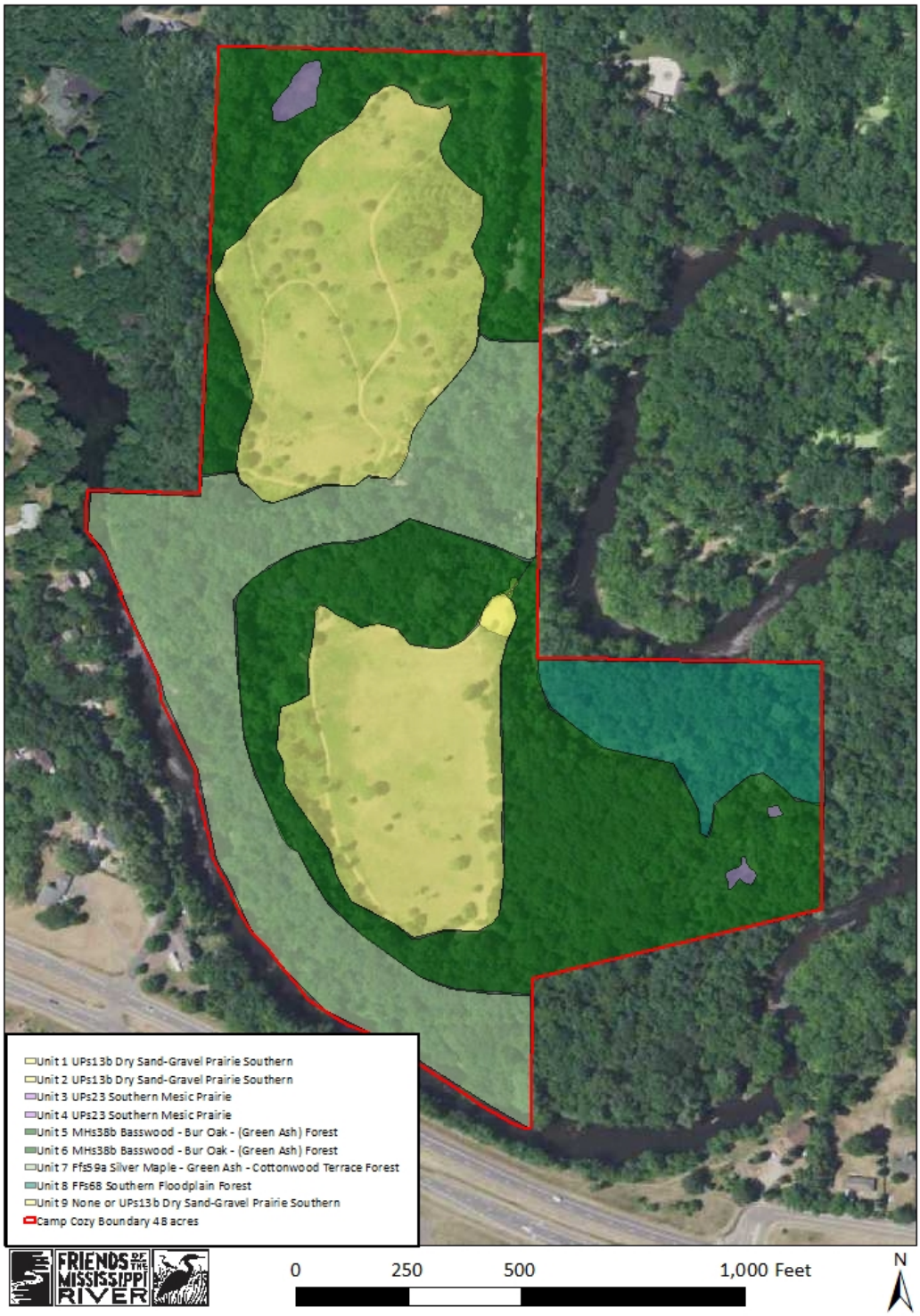


Table 2. Restoration Target Plant Communities for Existing Landcover

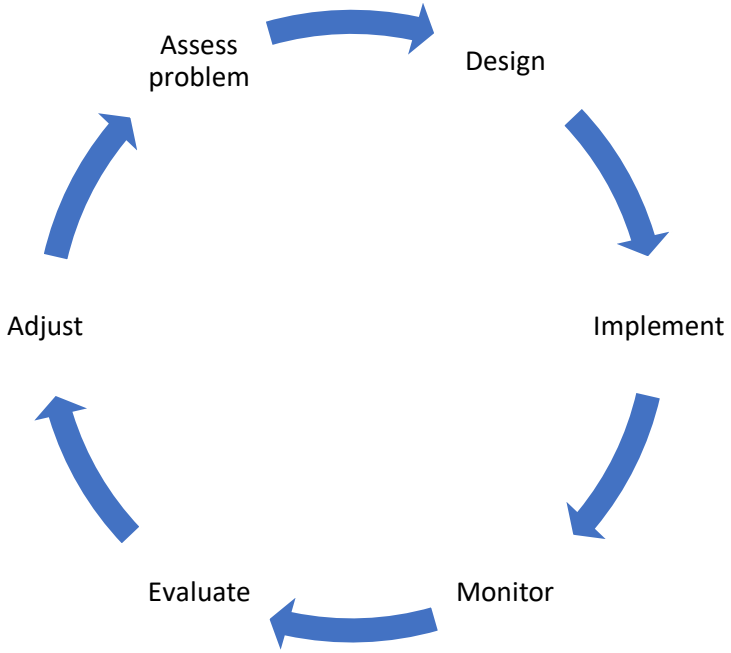
MLCCS Unit	Acres	Dominant Soil Types	Target Community
Dry oak savanna barrens	4.2	Hubbard (D67B), Elkriver (771), Elkriver-Mosford (1257)	MHs38b Basswood - Bur Oak - (Green Ash) Forest
Dry prairie barrens-north	8.8	Elkriver (1255), Elkriver (771)	UPs13b Dry Sand - Gravel Prairie (Southern)
Oak forest dry	20.6	Elkriver (1255)	MHs38b Basswood - Bur Oak - (Green Ash) Forest.
Dry prairie barrens-south	7.0	Elkriver (771), Elkriver (1255)	UPs13b Dry Sand - Gravel Prairie (Southern)
Lowland hardwood forest-east	3.4	Elkriver (771), Elkriver (1255)	FFs68 Southern Floodplain Forest.
Lowland hardwood forest-south	0.8	Elkriver (771), Elkriver (1255)	FFs68 Southern Floodplain Forest.
Mesic prairie-north and south	1.3	Udorthents, Pits/gravel (1028)	UPs23 Southern Mesic Prairie.
TOTAL	**46.1 acres***		

*The entire Camp Cozy property encompasses 48 acres. The MLCCS land cover acreage shown here does not account for 2 acres of open water on the Elk River, which is considered part of the property boundary.

Restoration Process

Restoration is a process which takes time. Returning ecosystems to functionality and diversity is complicated and costly, and ideal outcomes are not always attainable. Sometimes original plant communities can only be approximated, but habitat integrity can be restored with dedicated efforts. Many steps are typically involved in a successful restoration; even deciding when a restoration is complete or successful can be very difficult. Restoration should be viewed as a process, not a state of being. The primary goal is to achieve and maintain a diverse natural community at the site, though this does not always proceed in a linear fashion. Using the

concept of *adaptive management* will be key to continual progress at the site. Adaptive management is a strategy commonly used by land managers and integrates thought and action into the restoration process. It can be described as a strategy that uses evaluation, reflection and communication, and incorporates learning into planning and management. It is set up like a feedback loop and looks like this:



Thus, moving forward with restoration, each round of adaptive management refines and hones the process to better fit the conditions of the site. Emphasis of this strategy will be important to the longevity of this site.

Given Camp Cozy's proximity to other propagule (seed) sources with common buckthorn in abundance at its boundaries and the Elk River delivering weed seed in flood flows, some effort will be required to restore and maintain this site. Once initial restoration efforts are complete, some degree of site maintenance will be needed to protect the plant communities and the restoration investment. The amount and type of "edge" (rivers, adjacent lands, etc.) allows for a continual supply of propagules, many non-native and invasive. While managing propagules arriving from the river is impossible, engaging neighbors in the importance of restoration on their lands will not only help the restoration on the property be more successful - as it will reduce the potential seed source of non-native, invasive plants - but will also increase the size of natural communities being protected and managed in the area.

The restoration of the plant communities at Camp Cozy will be broken into phases. Each phase will address the restoration of each given target plant community prioritizing most imperiled habitats and then invasive species populations. However, restoration will ultimately be conducted based on available funds and resources and may not occur sequentially.

Reduction or elimination of woody cover within the remnant prairie units is the highest priority. Without this critical first step, sumac and other woody species will create even more dense

shade, and sun-loving dry prairie plants will be diminished and degrade the habitat further. Woody invasive species removal is the second priority which will improve habitat quality and decrease soil loss in the forested areas that are adjacent to the floodplain and river. Reestablishing an herbaceous layer and native shrub layer where woody invasive species have been removed is a third priority.

Restoration Goals

Natural resources restoration goals for Camp Cozy are centered on the native plant habitats within the site and the strong community value of preservation and protection of these habitats. From an ecological perspective, returning fire to the remnant dry prairies, reducing woody encroachment in the prairies, and managing woody invasive species are the key elements of habitat restoration. This approach aligns well with community values expressed at a public input meeting held in November 2023. Community members and Elk River Parks Commission members conveyed the unique experiences that they had at Camp Cozy because of its diverse habitats and special location and emphasized the need to protect and restore the rare plant communities.

Healthy ecosystems will support a variety of wildlife, reduce urban heating, increase water infiltration, build healthy soils that are less prone to erosion and create enhanced recreational opportunities like bird watching, fishing, hunting and nature observation. Toward achieving the goal of a healthier ecosystem, restoration will aim to improve the diversity, composition and structure of the plant communities throughout the property, which will also better reflect the historical plant community. This includes the restoration of prairie habitat that has been drastically lost throughout the state and improvement of Camp Cozy's woodlands and forests. Restoration does not, however, intend to convert current natural communities to what may have been present in the past. Restoration of degraded areas will improve the ecological functions that both historic native plant communities and current healthy communities provide, including:

- habitat for a diversity of wildlife species,
- nutrient and water cycling,
- carbon storage,
- moderation of water-table levels,
- erosion control,
- filtration of nutrients, sediments and pollutants,
- development and enrichment of soils,
- local temperature moderation.

Though somewhat degraded by fire suppression and unmanaged invasive species, the existing plant cover retains a good variety of native species and could be readily improved. A healthy and diverse plant community can provide much greater wildlife value than a degraded one, and tends to be much more stable, and less susceptible to disease, invasive species and other disturbances.

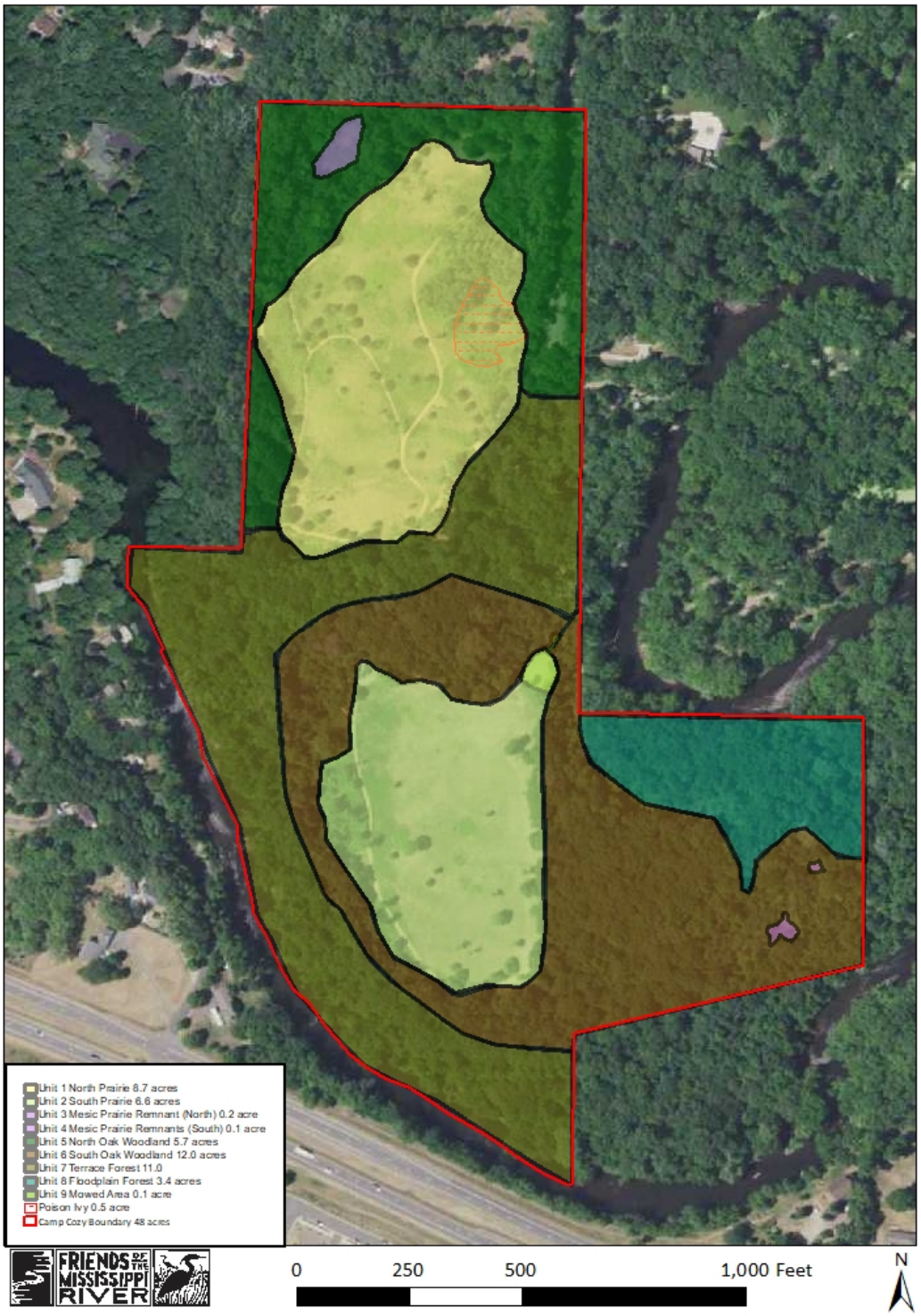
Management recommendations were developed for each manangement unit with the overall objectives for the property focused on protecting and restoring high quality habitat by restoring prairie, removing invasive plant species, and providing pollinator and wildlife habitat. Specific goals include the following, and are feasible by the fifth year of the restoration process:

1) Eliminate woody cover in the remnant dry prairies
2) Eliminate non-native herbaceous species in the dry prairies
3) Return fire to the remnant dry prairies
4) Reduce or eliminate invasive woody species within the forests and woodlands
5) Reintroduce native herbaceous plants and shrubs in the forests and woodlands
6) Engage the community and local volunteers through restoration events, including plantings, invasive species removals and trash clean-ups.

WORKPLAN

The following tasks and budget are based on current costs and project needs at the time the NRMP was created. All parties will collaborate to determine additional future tasks. Work units are shown in Figure 19. Methods for controlling non-native and invasive plant species and a list of ecological contractors can be found in Appendices C and D.

Figure 19: Restoration work units



Management Priorities

PRIORITY 1: Woody removal within Unit 1 North Prairie and Unit 2 South Prairie

The remnant dry prairies in Units 1 and 2 have drastically decreased in extent due to woody encroachment by smooth sumac, eastern red cedar and quaking aspen. While native prairie species are persisting in the shade of these woody species, some cool season grasses have become established, and this condition will only worsen with time.

The smooth sumac (2.2 acres in Unit 1 and 1.1 acre in Unit 2) should be cut in July or after flowering and triclopyr applied to every cut stem by dauber or wick application when temperatures are below 85 degrees Fahrenheit to prevent herbicide volatilization. Sumac is clonal, so care must be taken to treat all stems to prevent resprouting. Fire stimulates resprouting in sumac, so judicious spot foliar herbicide application may be needed after burning if the sumac is persisting. Cut sumac can be piled in the large, mowed areas of each prairie and burned in the winter when snow cover is present.

Extreme care should be taken with the use of herbicides and gas-powered equipment on this site given the proximity to the river, high potential for groundwater contamination and rare plant communities. Glyphosate binds to soil particles and is generally not mobile, so may be a better choice than other herbicides that are more mobile, especially near the water. However, triclopyr-based herbicides like Garlon 3A and 4 are generally more effective at preventing resprouts on cut shrubs and trees.

The quaking aspen encroaching the north prairie (0.5 acre) should be cut periodically to reduce its cover and slow the clone's further progression in the prairie. Cut stump herbicide application would affect the entire stand of aspen, which is not a desired goal. Conversely, fire will stimulate the growth of the aspen, so prescribed burns should generally avoid the northern tip of the north prairie.

The large eastern red cedar (approximately 50 trees) should be cut prior to prescribed burning. Cut material should be dragged into the peripheral forest areas to serve as winter cover for wildlife. Cut stump herbicide treatment is not necessary because cedar does not resprout. Smaller cedar can be left standing and consumed with prescribed fire; this species is very susceptible to burning.

Photo 9. Section of Unit 1 near park entrance has experienced significant woody encroachment, July 2023.

PRIORITY 2: Prescribed fire and minor weed management within Unit 1 North Prairie and Unit 2 South Prairie

The woody encroachment present in the remnant prairies is a result of fire suppression over the last 70-80 years and a lack of management. Fire has myriad benefits including:

- increased plant vigor and abundance when fire stimulates the growth of aboveground vegetation and induces more seeds to germinate,
- the recycling of important nutrients when organic matter is broken down releasing nutrients for plant growth,
- reduced woody competition and shading as woody species intolerant of fire are suppressed, and
- increased soil microbial activity in blackened, and hence, warmer soil.

Historically, dry prairies maintained their open character, species composition and habitat quality with fire on a return interval of less than 10 years. For management of these remnants with greater pressure from encroaching forests and a species composition with higher grass abundance, a prescribed burn interval of 4-6 years is recommended. While the two prairies are separated by only 300 feet, that gap is a dense forest. As such, the two prairies will not provide

refugia for each other. The prairies should not be burned in the same year, and each prairie should not be burned in its entirety. The internal trails of Unit 1 provide suitable firebreaks that can be made more robust with mowing just prior to a burn and thoroughly wetting the break itself. Unit 2, however, lacks internal trails. Burning in this prairie would require creating a temporary or permanent north-south fire break of at least 8 feet in width and burning the eastern half of the prairie first. To avoid stimulating growth of aspen and sumac, the northern two-thirds of the north prairie should be burned in the fall. Early fall burning will also suppress the cool season grasses (smooth brome and Kentucky bluegrass) that are present under the sumac and cedars.

Allowing fire to run into adjacent different vegetation types can soften the boundaries between habitat and benefit the vegetation outside of the intended burn unit. For example, the new firebreak in Unit 2 South Prairie should be routed to run a short distance into the nearby oak forest, where feasible. This makes for a more natural-looking and functioning landscape and helps to prevent the forest from encroaching into the prairie.

Smoke management is somewhat of a concern for burning at Camp Cozy with US Highway 10 just to the south of the site across the river and the risk of reduced visibility from smoke on the road. Burn prescriptions should specify a west or southwest wind that will move smoke to undeveloped areas along the river where it will not affect roadways or be a nuisance for neighbors.

In addition to smoke as a visibility concern, the density of poison ivy in Unit 1 will require extreme care during management, and especially during prescribed burning. An option would be to ignite flanking fire on the north and south edges of the unit, having the two ignition lines meet on the west edge of the unit, and allowing the head fire to burn through the poison ivy on the east side of the unit where burn personnel can be positioned behind the running fire and smoke is pushed to the east. If fire cannot be ignited in a pattern that allows the burn crew to stay out of smoke from burning poison ivy, the area should not be burned.

With disturbance from both woody removal and fire, weedy species that favor disturbance may briefly increase in abundance. To prevent their spread, occasional, judicious spot herbicide application is also recommended. Known weedy species are primarily limited to cool season grasses, and to prevent off-target damage, a grass-selective herbicide, such as sethoxydim, may be used.

Photo 10. Care will need to be taken when burning sections of prairie in Units 1 and 2 where significant poison ivy is present.

PRIORITY 3: Enhancing species diversity within Unit 1 North Prairie and Unit 2 South Prairie

Despite the gap in burning and resulting woody encroachment, both Unit 1 and 2 maintain a diverse, if graminoid-dominant, herbaceous layer. To enhance the species diversity of the prairies and boost the forb to grass ratio, supplemental seeding in the woody removal areas is recommended. Enhancing the plant community in remnant systems should be done carefully. Collection of seed from on-site or nearby remnant communities, such as the rail corridor on County Road 35 NW to the north of Camp Cozy. This approach will preserve the genetic diversity of the remnant with plants that are already adapted to local conditions. On-site or nearby seed collection is an excellent opportunity to involve the community in the restoration of Camp Cozy.

Another option is to source commercially harvested seed that has origins within a small radius (e.g., 50 miles) from Camp Cozy. Local ecotype seed should be obtained following the Minnesota Board of Water and Soil Resources (BWSR) seed collection criteria, moving from ecological subsection to ecological section to a maximum distance of 175 miles. To increase species diversity across many guilds, a combination of seed sources will likely be needed.

A goal of the restoration is to have at least 25 pollinator-supporting plants (including common and whorled milkweed) present in the prairies. These plants will provide important habitat and resources for pollinator populations in decline across the state and country. Milkweed plants are especially important habitat and food sources for monarch butterflies, as well as a host of other insect species.

PRIORITY 4: Invasive woody removal within Unit 5 North Oak Forest, Unit 6 South Oak Forest and Unit 7 Terrace Forest

Pockets of woody invasive species (primarily common buckthorn, and to a lesser extent, Tatarian honeysuckle) exist in Units 5, 6 and 7. The most dense and aged buckthorn is present in the southern edge of Unit 5 and the northeastern corner of Unit 7. The most economical method of managing these dense patches of woody invasive species is to forestry mow (using a Fecon mower with an ASV attachment or similar equipment). Hand cutting may be required in areas of Unit 7 due to the channels in this area. Where forestry mowing is possible, work will be limited to the winter months when the ground is frozen. This will limit damage to the native ground layer plant community and minimize soil disturbance.

Small pockets of buckthorn are also present in the eastern leg of Unit 6. Because of distribution of the buckthorn within the matrix of native trees and shrubs, hand cutting is recommended in this area. Hand cutting can be done at various times of the year, though the fall is recommended, as native plants will have senesced and buckthorn and other invaders, which have a slightly longer growing season, will be easier to identify. For hand-cutting, brush pile locations will need to be selected at the time of removal to ensure burn piles are safely located.

Because Camp Cozy is located in a Rusty-patched bumblebee (RPBB) High Potential Zone (Figure 8), burn piles must be located at least 100 feet from woodland edges to prevent harm to overwintering bees, which burrow in the soil of wooded edges. Mowed areas in both Unit 1 and Unit 2 are located more than 100 feet from woodland edges and are suitable locations for burn piles.

Generally, all management tasks must be conducted to avoid and minimize potential impacts to RPBB as per Section 7 guidance of the USFWS. This includes disturbance to bees:

- overwintering in surface soil and leaf litter of forest edges and forest interior from October 11 to April 9,
- nesting in the ground on the forest edge from April 10 to October 10,
- nesting in the ground of the grassland from April 10 to October 10,
- foraging in the forest interior from April 9 until flowers stop blooming,
- foraging in the grassland and forest edge from April 10 to October 10

If initial buckthorn removal is done well, stump-sprouting should only occur in small numbers (if at all), though these sprouts will need to be treated by mowing, cut and paint herbicide application, or foliar herbicide treatment. Follow-up treatments to manage new germinants will

be necessary for 3-4 years while the seedbank of buckthorn is exhausted. Periodic future follow-up may also be necessary because of new seed brought into the park from surrounding properties with heavy buckthorn cover. Treating germinating seedlings will be a difficult and repetitive process but can be accomplished through foliar herbicide application. Prescribed fire is a seedling management option in drier areas where herbaceous cover exists or can be established through seeding. Fire will not be a suitable option in many of the wetter terrace and floodplain areas. Prescribed burns should occur after mid-April as to protect pollinator habitat. This is also when buckthorn is actively growing, and its carbohydrate stores are low. In the more open areas of the property, seeding will be necessary after buckthorn removal. Cover of native plants will help to fill unoccupied niches and compete with and suppress germinating buckthorn seedlings.

PRIORITY 5: Rubbish removal within Unit 7 Terrace Forest and Unit 8 Floodplain Forest

Units 7 and 8 have considerable interaction with the Elk River with a wide, connected floodplain and terrace forest grading into upland areas of the park. Because the units receive frequent flood flows from the river, a considerable amount of garbage that has been deposited within these units. An annual park clean-up after the flood season would be a worthwhile volunteer or steward activity. No established trails traverse these units, and this would be an opportunity for the community to explore this part of the park, reach the river and potentially identify a future trail alignment that would connect existing trails to the river.

Photo 11. Tarps, siding, and other rubbish deposited on the ground in Unit 8 following flooding, July 2023.

Long-Term Monitoring and Maintenance

Monitoring is essential to restoration success. Regular site visits to evaluate and assess restoration outcomes should be done at least annually by an ecologist or a restoration professional. More frequent monitoring will be needed in the initial phases of restoration to evaluate the success of the methodology and to inform future strategies. Adapting to issues or factors observed during monitoring and assessment is vital to the restoration process.

Once the primary restoration tasks are completed, the restoration process will convert to a monitoring and adaptive management phase. Long-term maintenance for the forest areas will consist of managing for invasive species and monitoring every year for potential issues such as erosion of the side channels that receive flows during high water. For the prairies, burning should occur every 4 to 6 years to prevent woody encroachment and maintain the health of the habitat.

Restored areas must be regularly monitored to identify ecological issues, such as erosion and sedimentation, invasive species and disease. Monitoring is also important for detecting human-related issues such as illegal activities (ATV use, dumping, illegal hunting). Early detection of

concerns enables a quick response to address small issues before they become significant problems.

Monitoring wildlife and plant communities is also helpful for evaluating results of the restoration. A comparison of bird populations before and after restoration, for example, would be a valuable tool for quantifying positive impacts on the landscape. Trail cameras can also provide information about wildlife using the property. This is another opportunity for community involvement, and tie-ins with programs like Monitoring Avian Productivity and Survivorship (MAPS), eBird and eMammal would provide great community science opportunities.

5-Year Work Plan

A general time frame is shown in Table 3. Specific timelines for each task may shift dependent upon the timing of restoration, but this sequence should be maintained. Note also that that the costs shown are estimates, based on similar work at other sites in 2023, but actual costs may be higher or lower depending on the bidding climate and other logisitics.

Table 3. Restoration Schedule and Cost Estimates

The task tables below are general schedules and approximate costs for restoration and management tasks for Camp Cozy. Costs are likely to increase as the project progresses, and tasks may change as management requires adaptation to outcomes of restoration activities. Tasks are phased, with Phase 1 being the highest priority. Work units correspond with those shown in Figure 18.

Year	Season	Unit(s)	Activity	Acres/ Count	Cost/ Ac	Cost Est.
PHASE 1. REMNANT PRAIRIE MANAGEMENT						
0/1	June	Units 1, 2, 5, 7	Conduct breeding bird survey in representative habitat types prior to restoration.	32	-	$1,000
0/1	August	Units 1, 2	Conduct rusty patched bumble bee survey in prairie foraging habitat prior to burning	15.3	-	$1,000
1	June	Units 1, 2	Spot spray smooth brome with sethoxydim or another grass-specific herbicide.	1	$950	$950
1	June	Units 1, 2	Spot spray non-native thistles.	0.5	$950	$475
1	June, August	Units 1, 2	Cut and stump treat smooth sumac with triclopyr in dauber or apply by wicking or re-cut in August after resprouting. Haul sumac brush to mowed areas within center of Unit 1 or mowed area northeast of Unit 2, and pile for winter burning.	4	$2,500	$10,000
1	July	Unit 1	Cut encroaching quaking aspen. Haul cut aspen to mowed areas within center of Unit 1 and pile for winter burning.	1	$2,500	$2,500
1	July	Units 1, 2	Cut eastern red cedar over 4’ tall. Haul cut cedar to designated areas of woodlands.	2	$2,500	$5,000

Year	Season	Unit(s)	Activity	Acres/ Count	Cost/ Ac	Cost Est.
1	After October 10	Unit 1	Conduct prescribed burn of northern 2/3 of prairie allowing fire to run into north woodlands where feasible. Avoid ignition of 0.5-acre poison ivy patch or burn with head fire and avoid area until fire is extinguished.	7	$1,210	$8,470
1	Fall	Unit 1	Supplementally seed areas of woody removal. Includes seed cost and broadcast seeding.	5	$1,250	$6,250
1	Winter	Units 1, 2	Burn material cut during summer when snow cover is present.	2	$750	$1,500
Subtotal						$37,145
PHASE 2. REMNANT PRAIRIE MANAGEMENT						
2	June	Units 1, 2, 5, 7	Conduct breeding bird survey.	32	-	$1,000
2	August	Units 1, 2	Conduct rusty patched bumble bee survey in prairie foraging habitat post burning	15.3	-	$1,000
2	Before April 10	Unit 2	Establish mowed north to south firebreak dividing unit in half. Conduct prescribed burn of western half of prairie allowing fire to run into peripheral woodlands where feasible.	3.3	$1,210	$3,993
2	April	Unit 2	Supplementally seed areas of woody removal. Includes seed cost and broadcast seeding.	2	$1,250	$2,500
2	May	Units 1, 2	Spot spray smooth brome with sethoxydim or another grass-specific herbicide.	1	$950	$950
2	June	Units 1, 2	Spot spray non-native thistles.	0.5	$950	$425
Subtotal						$9,868
PHASE 3. WOODY INVASIVE SPECIES MANAGEMENT IN FORESTS AND WOODLANDS; PRAIRIE MAINTENANCE						
3	June	Units 1, 2, 5, 7	Conduct breeding bird survey.	32	-	$1,000
3	After October 10	Unit 1	Conduct prescribed burn of southern 1/3 of prairie unburnt in year 1, allowing fire to run into north woodlands where feasible.	3	$1,210	$3,630
3	Fall-Winter	Units 5, 6, 7	Hand cut and stump treat light density buckthorn and other non-native invasive shrubs. Pile cut material in woodland openings for winter burning. Create no more than 3 piles per unit.	17	$2,500	$42,500
3	Fall-Winter	Units 5, 6, 7	Burn cut material when snow cover is present.	9	$750	$6,750
3	Fall-Winter	Units 5, 6, 7	Forestry mow areas of dense buckthorn and other non-native invasive shrubs.	12	$1,750	$21,000
3	Fall-Winter	Units 5, 6, 7	Broadcast buckthorn replacement graminoid seed in areas of woody removal. Acreage assumes half of units have bare ground. Includes seed cost.	14	$750	$10,500

Year	Season	Unit(s)	Activity	Acres/ Count	Cost/ Ac	Cost Est.
4	Before April 10	Unit 2	Conduct prescribed burn of eastern half of prairie allowing fire to run into peripheral woodlands where feasible.	3.5	$1,210	$4,235
4	Early fall	Units 5, 6, 7	Conduct foliar herbicide application of resprouted and newly germinated woody invasive shrubs using Garlon 3A at 20% concentration.	29	$600	$17,400
5	May	Units 1, 2	Spot spray smooth brome with sethoxydim or another grass-specific herbicide.	1	$950	$950
5	June	Units 1, 2	Spot spray non-native thistles.	1	$950	$950
5	July	Unit 1	Cut encroaching quaking aspen. Haul cut aspen to mowed areas within center of Unit 1 and pile for winter burning.	1	$2,500	$2,500
5	Early fall	Units 5, 6, 7	Conduct foliar herbicide application of resprouted and newly germinated woody invasive shrubs using Garlon 3A at 20% concentration.	29	$500	$14,500
Subtotal						$125,915
TOTAL						$172,928

Long Term Management

Once initial phases of restoration are complete, long-term management ensues. The table below includes tasks that are required to be done periodically to maintain a stable native plant community. Table 4 lists these tasks with associated cost estimates.

Table 4. Long-Term Management Schedule and Cost Estimates

Season	Units	Activity	Acres	Cost/ Ac	Cost Est.
Spring or fall	Units 1, 2	Burn the prairie units every 4-6 years. Rotate burn units within management units and between management units. To provide refugia, do not burn adjacent units in consecutive years. Do not burn more than 2/3 of the prairie in one year. Rotate burns from spring to fall.	15.3 (Units 1 and 2)	-	$3,600 (per unit)
Fall	Units 1, 2	Monitor and manage for invasive herbaceous species and encroachment of native woody species.	4	$2,500	$10,000
July-Aug and Winter	Units 5, 6, 7, 8	Monitor ash for Emerald Ash Borer, bur oaks for Oak Wilt disease (July-Aug) and for Bur Oak Blight (July-Aug for leaf necrosis and winter for marcescent leaves (those that do not drop).	All	-	$1,000
Fall, summer, spring	All	Evaluation and assessment by ecologist	All	-	$1,200
June	Units 1, 2, 5, 7	Yearly breeding bird surveys after restoration tasks are complete. Establish citizen science programs (MAPS, eMammal, eBird)	-	-	$1,000
Spring and Fall	All	Yearly community engagement or volunteer event. Possible events include invasive species removal, prairie seed collection, trash clean-ups.	All	-	$2,000
TOTAL					$ 18,800 (at intervals)

SITE PROGRAMMING

The purpose of the Natural Resources Management Plan is to provide recommendations for the restoration and maintenance of natural resources at the park, and as such, it does not attempt to prescribe future park programming. The City of Elk River will develop a park master plan in 2025, including potential future programming options. Future site programming at the Camp Cozy property should be considered in concert with the restoration and management actions recommended by this plan and expressed as priorities by the community of Elk River.

Through conversations with the City of Elk River and a public meeting held on November 8, 2023, FMR ecologists solicited feedback on the natural resources management plan and received feedback about potential future site programming. Presented here some of the ideas and alternatives that were proposed.

CHARACTER

There is strong interest from community members in preserving the passive recreational use and natural character of the Camp Cozy property. Community members expressed an emphasis on restoring native plant communities, improving habitat and incorporating interpretive and orientation signage.

NAME

There is interest from some community members in re-naming Camp Cozy. Others feel that preserving the current name is an important nod to the property's resort history. It was mentioned at the public meeting that the name "Camp Cozy" creates confusion for the community and city staff when visitors expect camping amenities to be available. A new name that acknowledges the original indigenous stewards of the land was proposed.

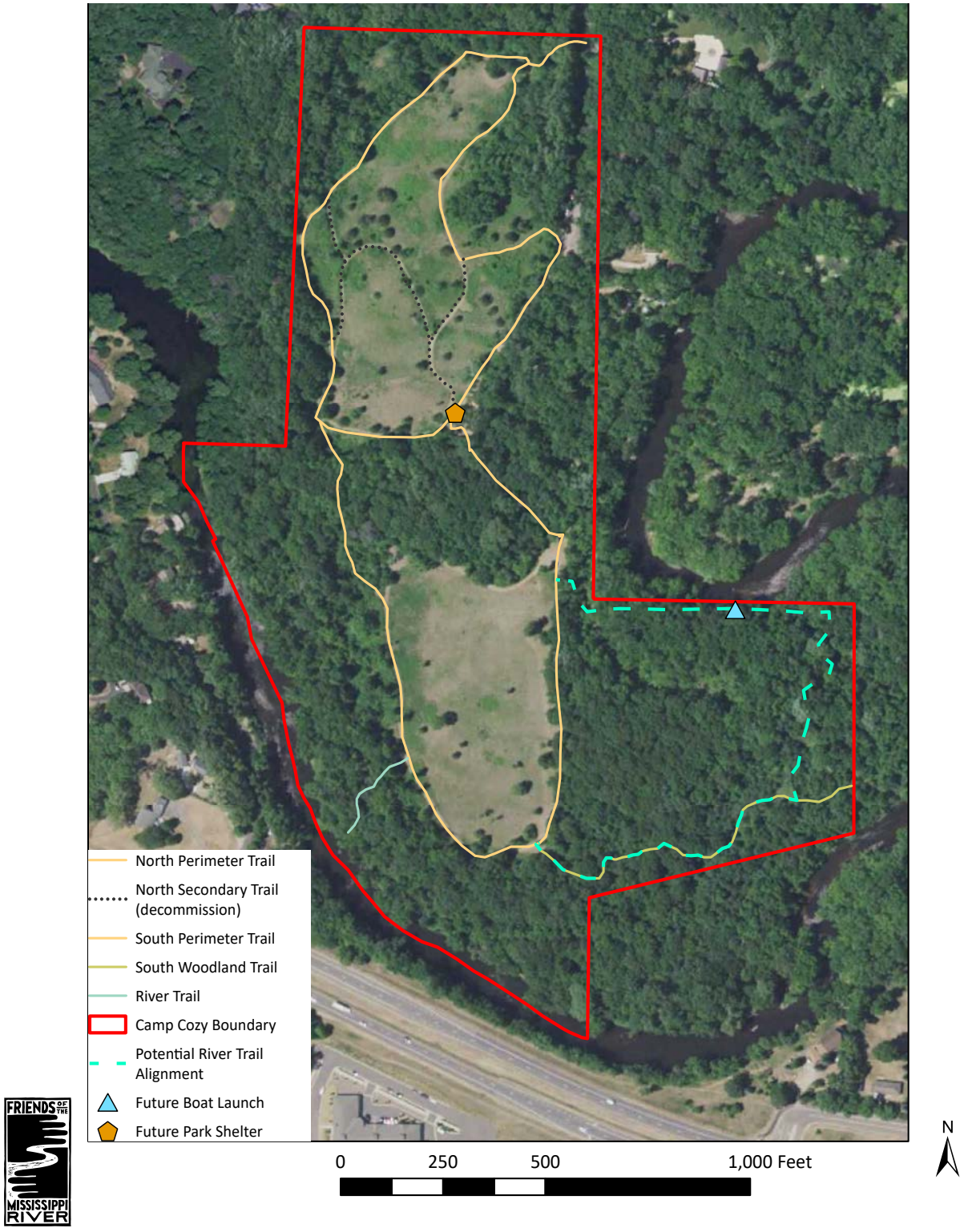
TRAILS

The current trail network at the Camp Cozy property (Figure 20) predominantly provides access to the north and south dry prairies and the oak forest. As of 2023, trails are mowed by a former neighbor of the Camp Cozy property who volunteers their time. Narrowing and reducing redundant trails, especially in the north prairie Unit 1, is an option that would help retain important remnant prairie and reduce erosion and the spread of invasive species, but some internal trails should be maintained as fire breaks.

There are currently no maintained trails granting access to the Elk River. The community expressed interest in adding trails that access the Elk River to increase the recreational value of the park and offer an opportunity to launch canoes and kayaks from Camp Cozy. A proposed potential trail route of 2000 feet (0.4 mile) is also shown in Figure 20 as a dashed line. This route takes advantage of the property's frontage on the Elk River and uses a portion of an existing path in the oak forest leading from a large, mowed area which could serve as a future

programmed park space. If establishing a trail in this area is pursued, an alignment area for the construction of the trail should be removed from future restoration acres.

Figure 20: Existing trails and potential future amenity and trail improvements



The City of Elk River is considering the possibility of paving some trails to increase park accessibility in the future. If this is done, it is recommended that existing trails are paved rather than creating newly established paved trails that would further fragment habitat.

Photo 12. Existing trail through the prairie in Unit 1, June 2023.

BOAT LAUNCH

There is interest in adding a canoe and kayak launch along the Elk River that can be accessed by new a river trail. There is a stretch of rapids just upstream of the Camp Cozy property, and paddlers could use the launch to paddle upstream or as a take-out location before the Orono Dam further downstream.

SIGNAGE

Signage is needed at the Camp Cozy property to increase accessibility and add recreational value. The community expressed this need, and park users would benefit from both trail and interpretive signage to guide them through the park and provide background information and orientation to the habitats at Camp Cozy.

OTHER CONSIDERATIONS

Hunting

To manage the population of white-tailed deer, the City of Elk River organizes a controlled archery hunt in Camp Cozy during the archery season (mid-September to the end of December). Two hunters are permitted to hunt within Camp Cozy from elevated deer stands. Since the property will be open to hunting during that period, several measures will need to be taken to ensure that the property is restored safely.

First, restoration crews will need to be notified that hunting is occurring on the property, and crews should wear brightly colored clothing to denote their presence. While this is standard for most contractors, care should be taken to remind them of this during the first and subsequent site visits. Temporary signage is typically erected at the southern parking area to alert visitors that hunting is occurring on the property.

Tree Disease (Dutch elm disease, Emerald ash borer, Oak wilt, Bur oak blight)

Dutch Elm Disease and Emerald Ash Borer

There are many elms and large green and black ash trees growing within the oak, terrace and floodplain forests along the Elk River at the site. These trees are not only ecologically valuable but are also at high risk to attack from non-native tree pests. Elms are susceptible to Dutch Elm Disease and Ash are susceptible to Emerald Ash Borer. These tree pests have caused widespread mortality of elms and ash throughout the eastern United States and in Minnesota.

Dutch Elm disease is a fungal infection caused by the fungus *Ceratocystis ulmi*, which is native to Asia and is spread by both native and non-native bark beetles (family: Curculionidae). Once the fungus is introduced onto a tree, the tree reacts by sealing its own xylem tissues (conduits of water and nutrients) to prevent further spread. This effectively prevents water and nutrients from reaching the upper branches, causing gradual die-off as more and more of the xylem is sealed. Symptoms include a yellowing and browning of leaves that spreads from the outer crown toward the trunk. Dutch elm disease was first recorded in Minnesota near Monticello in 1961 and has since spread throughout the state. Minnesota relied heavily on American elms (*Ulmus americana*) as shade trees on streets, with about 140 million in the state at the time of the outbreak. The disease is now present in all Minnesota counties, though elms remain an important component of many Minnesota forests.

Emerald ash borer (EAB) is a non-native wood-boring beetle from Asia that was first identified in the United States in the summer of 2002. Likely transported from Asia to Michigan in ash wood used for pallets and other shipping materials, the beetle has now been confirmed in 36 states, including Minnesota. The beetle works by depositing larvae under the bark of the tree; these larvae then feed on the wood, eventually disrupting enough of the phloem to prevent the transport of nutrients throughout the tree. While Minnesota's cold weather can stymie the spread of the beetle, it continues to spread and is present in Sherburne County and at Camp Cozy.

The elms and ash at Camp Cozy are at risk of dying in the near future, and many dead crowns of green ash can be seen when viewing the canopy of the forested areas. When such large trees die, it will have a pronounced effect on the understory vegetation and the water in the river. These trees act to shade the water and provide habitat and improve water quality for fish and other species. When large trees die, they open the canopy and create gaps, which releases the understory that was formerly suppressed by the shade from such trees. If desirable species like native forbs, grasses, sedges, and shrubs exist in the understory, then this can have a positive effect since the result will probably be a net increase in bank stability and diversity. In the case of this property, these canopy gaps will likely be filled by buckthorn and Tatarian honeysuckle, which are poised to take advantage of such a situation. To avoid this undesirable scenario, active management is recommended. Removal of undesirable shrub species and replacement with desirable native shrubs and herbaceous plant species is a recommended management strategy.

For green ash in particular, the situation is particularly important, as this species makes up over 50% of the canopy in many areas of the floodplain forest. The principle of risk is highly applicable here; risk is often defined as the probability of a negative event weighted by its consequences. In the case of EAB, the consequences will be large and quite negative, as a loss of half the canopy on the property could have cascading consequences for invasive species, water quality, and wildlife. The probability that EAB arrives is high, though it is unclear when this will occur. While we plan to remove invasive species prior to this occurring, which will reduce some of the negative consequences, another potential strategy is to proactively remove the ash from the property. This would be a large undertaking, as the ash would have to be removed and replaced by other floodplain species. Removal could be contracted to logging firms, which could potentially fund the work, though the market for ash in the county is relatively sparse and this technique unlikely to create any profit for the city. Ultimately, removal should occur once invasive species are removed, and could occur in stages (10-20% per year) to minimize disturbance to the community. However, removal will realistically have a large negative impact on the property, especially in floodplain areas and to neighboring trees. The removal would also have to be timed to minimize impacts on the prairie restoration process. Advice from the city or county should be solicited when making these decisions.

Oak Wilt and Bur Oak Blight

Oak wilt is an increasingly common tree disease caused by the fungus *Ceratocystis fagacearum*. While the disease is present in many eastern US states, it is most prevalent in the Midwestern US. Within Minnesota, it is an issue of serious concern in and around the seven-county metro area, including in Sherburne County. Oak wilt affects all of Minnesota's most common oak species (red oak [*Quercus rubra*], pin oak [*Q. ellipsoidalis*], bur oak [*Q. macrocarpa*], and white oak [*Q. alba*]), though it does not affect these species equally. Red and pin oak are the most susceptible species, with infected individuals wilting in six weeks or less. Bur and white oaks may take years to wilt completely and may only do so one branch at a time. The fungus can be transported from tree to tree by sap beetles, but most commonly spreads through root grafts. The beetles are attracted to the fungal mats created when mature oaks die from oak wilt, and also to wounds on uninfected oaks, providing a convenient pathway of spread for the fungus.

Oaks commonly form root grafts between individuals, allowing direct transfer of the fungus from infected to healthy individuals.

The Camp Cozy property has many red and pin oaks, and this increased the likelihood of Oak wilt infection, as these species are most susceptible. Careful monitoring of individuals will be necessary to identify and manage infected trees. If infected individuals are found, root barriers may be installed around those trees using a vibratory plow. Other options include soil sterilization and inoculation of high value individual trees. Care should also be taken to avoid injuring trees during the early growing season (April to July), when trees are most susceptible to the fungal spread. If a tree is injured during this time, covering the wounds is recommended. If pruning or other activities must be done, waiting for the winter is the safest option.

Bur oak blight (BOB) may be a more serious threat to the oaks on the property. BOB affects only bur oaks and is most injurious to upland individuals in savanna remnants like at Camp Cozy. Caused by a species of fungus in the *Tubaki* genus, BOB causes lesions and discoloration of the veins on the underside of the leaves, eventually causing large portions of the leaf to die. In many cases, severe infections will cause tree death, though individual susceptibility to the disease varies. The fungus can overwinter on leaf petioles that remain attached to trees and is primarily spread by rain droplets moving spores throughout the tree. Early results suggest that inoculation of trees with fungicide may help slow or stop the spread of the disease within individual trees. At Camp Cozy, monitoring existing oaks for symptoms will be an important first step; moreover, if oaks are planted in the future, it may be beneficial to avoid planting the variety *Q. macrocarpa var. oliviformis*, which has shown the most severe susceptibility to BOB.

INFORMATION SOURCES

Dutch elm disease: https://extension.umn.edu/plant-diseases/dutch-elm-disease

Emerald ash borer: https://www.mda.state.mn.us/eab

Minnesota Department of Natural Resources (2001) Minnesota Land Cover Classification System. MNDNR. https://www.dnr.state.mn.us/mlccs/index.html

Minnesota Department of Natural Resources (2005) Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR.

Minnesota Geospatial Commons: https://gisdata.mn.gov/

Minnesota Wildflowers, a field guide to the flora of Minnesota: https://www.minnesotawildflowers.info/page/whats-blooming/april-native-plants

Oak wilt: https://extension.umn.edu/plant-diseases/oak-wilt-minnesota

APPENDICES

APPENDIX A. Plant Species Recorded at Camp Cozy

The following plant species were identified at the Camp Cozy property by Friends of the Mississippi River during four vegetation surveys on May 23, June 26, July 20, and September 14, 2023. N = Native, NN = Non-Native, I = Invasive. Species marked with an "x" are present in that unit.

PRAIRIE

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Groundcover						
Tilia americana	American basswood	N	x			
Celastrus scandens	American bittersweet	N	x			
Ulmus americana	American elm	N	x			
Anemone patens	American pasqueflower	N	x			
Acer ginnala	Amur maple	I	x			
Agastache foeniculum	Anise hyssop	N	x		x	
Comandra umbellata	Bastard toadflax	N		x		
Carex bebbii	Bebb's Sedge	N	x			
Monarda fistulosa	Bee balm	N	x	x	x	x
Andropogon gerardii	Big bluestem	N	x	x	x	x
Lotus corniculatus	Birds-foot trefoil	I		x		
Rubus occidentalis	Black raspberry	N	x			x
Rudbeckia hirta	Black-eyed susan	N	x		x	
Silene vulgaris	Bladder campion	NN	x			
Liatris aspera	Rough blazing star	N	x			
Bouteloua gracilis	Blue grama	N	x	x		
Acer negundo	Boxelder	N	x			
Quercus macrocarpa	Bur oak	N	x	x	x	
Asclepias tuberosa	Butterfly weed	N	x	x		
Solidago canadensis	Canada goldenrod	N	x		x	
Carex bicknelli	Carex bicknellii	N	x			
Delphinium carolinianum	Carolina larkspur	N				x

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Physalis heterophylla	Clammy ground cherry	N	x	x	x	
Lycopodium	Clubmoss sp.	N	x			
Eupatorium perfoliatum	Common boneset	N				
Rhamnus cathartica	Common buckthorn	I	x			
Potentilla simplex	Common cinquefoil	N	x			
Asclepias syriaca	Common milkweed	N	x	x	x	x
Verbascum thapsus	Common mullein	N	x	x	x	
Ambrosia artemisiifolia	Common ragweed	N			x	
Achillea millefolium	Common yarrow	N	x	x		x
Veronicastrum virginicum	Culver's root	N	x			x
Taraxacum officinale	Dandelion	NN	x			
Onosmodium bejariense	False gromwell	N	x			
Artemisia campestris	Field sagewort	N	x			
Cirsium discolor	Field thistle	N				x
Carex vulpinoidea	Fox sedge	N	x			
Tragopogon sp.	Goat's beard	NN	x			
Ratibida pinnata	Gray-headed coneflower	N	x	x		
Hypericum ascyron	Great St. Johnswort	N	x			x
Fraxinus pennsylvanica	Green ash	N	x			
Smilax sp.	Greenbrier	N	x			
Hieracium longipilum	Hairy hawkweed	N		x		
Vicia villosa	Hairy vetch	NN	x	x		
Campanula rotundifolia	Harebell	N				
Symphyotrichum ericoides	Heath aster	N	x		x	
Berteroa incana	Hoary alyssum	N	x	x	x	x

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Verbena stricta	Hoary vervain	N	x	x		x
Equisetum sp.	Horsetail	N	x	x	x	x
Sorghastrum nutans	Indian grass	N	x	x		
Carex eburnea	Ivory sedge	N			x	
Koeleria macrantha	Junegrass	N		x		
Bromus kalmii	Kalm's brome	N	x	x		
Poa pratensis	Kentucky bluegrass	I	x			
Scrophularia lanceolata	Lance-leaf figwort	N	x			
Penstemon grandiflorus	Large-flowered beardtongue	N	x	x		
Amorpha canescens	Leadplant	N				x
Schizachyrium scoparium	Little bluestem	N	x	x	x	x
Cerastium fontanum	Mouse-ear chickweed	N	x			
Hesperostipa comata	Needle-and-thread grass	N	x	x		x
Oenothera parviflora	Northern evening primrose	N	x			
Asclepias ovalifolia	Oval-leaved milkweed	N	x			
Anaphalis margaritacea	Pearly everlasting	N	x			
Toxicodendron rydbergii	Poison ivy	N	x	x		
Asclepias exaltata	Poke milkweed	N	x			
Hesperostipa spartea	Porcupine grass	N	x		x	
Sisyrinchium campestre	Prairie blue-eyed grass	N	x			
Sporobolus heterolepis	Prairie dropseed	N				x
Erigeron strigosus	Prairie fleabane	N	x	x	x	
Artemisia frigida	Prairie sagewort	N	x	x		
Geum triflorum	Prairie smoke	N	x			
Tradescantia occidentalis	Prairie spiderwort	N	x	x		

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Zanthoxylum americanum	Prickly ash	N	x	x		
Dalea purpurea	Purple prairie clover	N	x	x		
Vicia americana	Purple vetch	N	x			
Antennaria sp.	Pussytoes	N	x	x		
Populus tremuloides	Quaking aspen	N	x			x
Quercus rubra	Red oak	N	x			
Phalaris arundinacea	Reed canary grass	I	x			
Vitis riparia	Riverbank grape	N	x			
Streptopus lanceolatus	Rose twisted-stalk	N	x			
Lespedeza capitata	Round-headed bush clover	N	x	x		x
Dichanthelium scribnerianum	Scribner's panic grass	N	x	x	x	x
Prunella vulgaris	Self-heal	N	x		x	
Carex brevior	Short-beak Sedge	N	x			
Desmodium canadense	Showy tick-trefoil	N	x			
Ulmus pumila	Siberian elm	N	x			
Bouteloua curtipendula	Side-oats grama	NN	x			
Cyperus lupulinus	Slender nutsedge	N	x			
Symphyotrichum laeve	Smooth blue aster		x			
Heliopsis helianthoides	Smooth oxeye	N	x			
Rhus glabra	Smooth sumac	N	x	x		
Hypericum sp	St. Johnswort	N	x			
Solidago rigida	Stiff goldenrod	N	x	x		
Helianthus pauciflorus	Stiff sunflower	N		x		
Potentilla recta	Sulphur cinquefoil	NN	x			
Panicum virgatum	Switchgrass	N	x			x
Thalictrum dasycarpum	Tall meadow rue	N	x			
Anemone virginiana	Tall thimbleweed	N				x

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Lonicera tatarica	Tatarian honeysuckle	I	x			
Anemone cylindrica	Thimbleweed	N	x	x		
Cirsium sp.	Unknown thistle		x			x
Viola sp.	Violet	N	x			
Clematis virginiana	Virgin's bower	N	x			
Parthenocissus quinquefolia	Virginia creeper	N	x			
Ambrosia psilostachya	Western ragweed	N	x			
Silene latifolia	White campion	NN	x			
Quercus alba	White oak	N	x			
Dalea candida	White prairie clover	N	x	x		
Geranium maculatum	Wild geranium	N	x			
Lupinus perennis	Wild lupine	N	x			
Rosa arkansana	Wild rose	N		x		
Fragaria virginiana	Wild strawberry	N		x		
Oxalis stricta	Yellow wood sorrel	N			x	
Understory/shrub layer						
Populus tremuloides	Quaking aspen	N	x			
Rhamnus cathartica	Common buckthorn	I	x		x	
Prunus pensylvanica	Pin cherry	N	x			
Zanthoxylum americanum	Prickly ash	N	x		x	
Juniperus virginiana	Eastern red cedar	N	x			
Quercus rubra	Northern red oak	N	x			
Pinus resinosa	Red pine	N	x			
Ulmus pumila	Siberian elm	I	x	x		
Spiraea sp.	Spiraea	N		x		
Rhus glabra	Smooth sumac	N	x	x	x	
Lonicera tatarica	Tatarian Honeysuckle	I	x			
Quercus alba	White oak	N	x			

Scientific name	Common name	Status	Unit 1	Unit 2	Unit 3	Unit 4
Salix sp.	Willow	N	x			

Canopy, subcanopy

Acer negundo	Boxelder	N		x		
Quercus macrocarpa	Bur oak	N	x			
Juniperus virginiana	Eastern red cedar	N	x			
Fraxinus pennsylvanica	Green ash	N		x		
Thuja occidentalis	White cedar	N		x		
Quercus rubra	Northern red oak	N	x	x		
Ulmus pumila	Siberian elm	I		x		
Quercus alba	White oak	N	x			

OAK FOREST

Scientific name	Common name	Status	Unit 5	Unit 6
Groundcover				
Rubus occidentalis	Black raspberry	N	x	x
Sanguinaria canadensis	Bloodroot	N	x	x
Solidago canadensis	Canada goldenrod	N	x	x
Maianthemum canadense	Canada mayflower	N	x	x
Maianthemum canadense	Canada mayflower	N	x	x
Aquilegia canadensis	Columbine	N	x	
Rhamnus cathartica	Common buckthorn	I	x	x
Hemerocallis fulva	Day Lily	NN	x	
Maianthemum racemosum	False-solomon's seal	N	x	x
Scrophularia sp.	Figwort	N	x	x
Chamaenerion angustifolium	Fireweed	N	x	
Smilax sp.	Greenbrier	N	x	x
Celtis occidentalis	Hackberry	N	x	
Equisetum sp.	Horsetail	N	x	x
Arisaema triphyllum	Jack-in-the-pulpit	N	x	x
Athyrium filix-femina	Lady fern	N	x	x
Syringa sp.	Lilac	NN	x	
Carex pedunculata	Long-stalked sedge	N	x	x
Viburnum opulus	American highbush cranberry	N	x	x
Ribes missouriense	Missouri gooseberry	N	x	x

Scientific name	Common name	Status	Unit 5	Unit 6
Galium boreale	Northern bedstraw	N	x	x
Carex pensylvanica	Pennsylvania sedge	N	x	x
Desmodium glutinosum	Pointed-leaf tick trefoil	N		x
Toxicodendron rydbergii	Poison ivy	N	x	x
Phalaris arundinacea	Reed canary grass	I	x	
Vitis riparia	Riverbank grape	N	x	x
Streptopus lanceolatus	Rose twisted-stalk	N	x	x
Bromus inermis	Smooth brome	I	x	x
Polygonatum biflorum	Smooth Solomon's seal	N		x
Maianthemum stellatum	Starry false Solomon's seal	N	x	
Carex rosea	Starry sedge	N	x	x
Osmorhiza claytonii	Sweet Cicely	N	x	
Drymocallis arguta	Tall cinquefoil	N	x	x
Thalictrum dasycarpum	Tall meadow rue	N	x	x
Anemone cylindrica	Thimbleweed	N	x	x
Clematis virginiana	Virgin's Bower	N	x	x
Parthenocissus quinquefolia	Virginia creeper	N	x	x
Hackelia virginiana	Virginia stickseed	N	x	x
Hydrophyllum virginianum	Virginia waterleaf	N	x	x
Elymus virginicus	Virginia wild rye	N		x
Geum canadense	White avens	N		x
Actaea pachypoda	White baneberry	N	x	x
Lysimachia quadrifolia	Whorled loosestrife	N		x
Aquilegia canadensis	Wild columbine	N	x	x
Geranium maculatum	Wild geranium	N	x	x
Fragaria virginiana	Wild strawberry	N		x
Laportea canadensis	Wood nettle	N	x	x
Solidago flexicaulis	Zigzag goldenrod	N	x	x

Understory/shrub layer

Acer ginnala	Amur maple	I	x	
Prunus serotina	Black cherry	N	x	
Acer negundo	Boxelder	N		x
Rhamnus cathartica	Common buckthorn	I	x	x
Hesperis matronalis	Dames rocket	I	x	x
Cornus racemosa	Gray dogwood	N	x	x
Zanthoxylum americanum	Prickly ash	N	x	x
Populus tremuloides	Quaking aspen	N	x	x
Cornus sericea	Red-osier dogwood	N		x
Quercus bicolor	Swamp white oak	N	x	x

Scientific name	Common name	Status	Unit 5	Unit 6
Lonicera tatarica	Tatarian Honeysuckle	I	x	x
Parthenocissus quinquefolia	Virginia creeper	N	x	
Rosa arkansana	Wild rose	N		x
Menispermum canadense	Canada moonseed	N	x	

Canopy, subcanopy

Tilia americana	American basswood	N	x	x
Quercus macrocarpa	Bur oak	N	x	x
Juniperus virginiana	Eastern red cedar	N	x	
Populus deltoides	Cottonwood	N	x	
Celtis occidentalis	Hackberry	N	x	x
Quercus ellipsoidalis	Pin oak	N	x	
Populus tremuloides	Quaking aspen	N	x	x
Quercus rubra	Northern red oak	N	x	x
Acer saccharinum	Silver maple	N	x	x
Salix sp.	Willow	N	x	

TERRACE FOREST

Scientific name	Common name	Status	Unit 7

Groundcover

Carex stipata	Awl-fruited sedge	**N**	x
Sanguinaria canadensis	Bloodroot	N	x
Iris versicolor	Blueflag iris	N	x
Thelypteris palustris	Northern marsh fern	N	x
Plantago major	Common plantain	NN	x
Glechoma hederacea	Creeping charlie	I	x
Glyceria striata	Fowl manna grass	N	x
Alliaria petiolata	Garlic mustard	I	x
Solidago sp.	Goldenrod sp.	N	x
Carex lupulina	Hop sedge	N	x
Arisaema triphyllum	Jack-in-the-pulpit	N	x
Carex retorsa	Retrose sedge	N	x
Leersia oryzoides	Rice cutgrass	N	x
Vitis riparia	Riverbank grape	N	x
Onoclea sensibilis	Sensitive fern	N	x
Persicaria sp.	Smartweed	N	x
Urtica dioica	Stinging nettle	N	x

Scientific name	Common name	Status	Unit 5	Unit 6
Laportea canadensis	Wood nettle	N	x	
Parthenocissus quinquefolia	Virginia creeper	N	x	
Hackelia virginiana	Virginia stickseed	N	x	
Hydrophyllum virginianum	Virginia waterleaf	N	x	
Understory/shrub layer				
Rhamnus cathartica	Common buckthorn	I	x	
Ribes missouriense	Missouri gooseberry	N	x	
Cornus sericea	Red osier dogwood	N	x	
Canopy, subcanopy				
Acer negundo	Boxelder	N	x	
Celtis occidentalis	Hackberry	N	x	
Quercus rubra	Northern red oak	N	x	
Acer saccharinum	Silver maple	N	x	
Quercus alba	White oak	N	x	

FLOODPLAIN FOREST

Scientific name	Common name	Status	Unit 8
Groundcover			
Sanguinaria canadensis	Bloodroot	N	x
Iris versicolor	Blueflag iris	N	x
Sagittaria latifolia	Broad-leaf arrowhead	N	x
Thelypteris palustris	Northern marsh fern	N	x
Glechoma hederacea	Creeping charlie	I	x
Alliaria petiolata	Garlic mustard	I	x
Smilax sp.	Greenbrier	N	x
Solidago sp.	Goldenrod sp.	N	x
Arisaema triphyllum	Jack-in-the-pulpit	N	x
Zanthoxylum americanum	Prickly ash	N	x
Leersia oryzoides	Rice cutgrass	N	x
Vitis riparia	Riverbank grape	N	x
Onoclea sensibilis	Sensitive fern	N	x
Equisetum laevigatum	Smooth scouring rush	N	x
Urtica dioica	Stinging nettle	N	x
Parthenocissus quiquefolia	Virginia creeper	N	x
Geranium maculatum	Wild geranium	N	x

Scientific name	Common name	Status	Unit 5	Unit 6
Laportea canadensis	Wood nettle	N		x
Understory/shrub layer				
Rhamnus cathartica	Common buckthorn	I		x
Cornus sericea	Red osier dogwood	N		x
Canopy, subcanopy				
Acer negundo	Boxelder	N		x
Celtis occidentalis	Hackberry	N		x
Quercus rubra	Northern red oak	N		x
Acer saccharinum	Silver maple	N		x
Quercus alba	White oak	N		x

APPENDIX B. MN DNR Native Plant Communities and Recommended Plant Species

The following plant, shrub and tree species are included in the Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest (DNR 2005). They are representative of each native plant community. Not all species are readily available from the nursery industry. Some species are not suited for restoration in areas with human use (i.e., poison ivy)

UNITS 1 and 2: Southern Dry Prairie (UPs13)
UPs13b Dry Sand - Gravel Prairie (Southern) does not include its own species list

UPs13 description: Grass-dominated herbaceous communities on level to steeply sloping sites with droughty soils. Moderate growing-season moisture deficits occur most years, and severe moisture deficits are frequent, especially during periodic regional droughts. Historically, fires probably occurred every few years.

UPs13b Dry Sand - Gravel Prairie (Southern) description: Graminoid-dominated, forb-rich herbaceous communities on coarse-textured, usually gravelly soils on gentle or occasionally steep slopes on outwash and ice-contact deposits. Soils are characterized by mollic epipedons. UPs13b shares many species with UPs13c and 13d that are rare in UPs13a; species with this pattern that are most common in UPs13b are side-oats grama, plains muhly, and prairie dropseed. Less common species include needle-and-thread grass (*Stipa comata*), silky aster, bastard toadflax (*Comandra umbellata*), tall cinquefoil (*Potentilla arguta*), stiff goldenrod, and aromatic aster (*Aster oblongifolius*). Species shared with UPs13a but rare in UPs13c and UPs13d are sand reedgrass, sand dropseed, western ragwort, and large-flowered beard tongue (*Penstemon grandiflorus*). Sage wormwood is most common in UPs13b but is sometimes also present in UPs13a. Field chickweed (*Cerastium arvense*) and thread-leaved sedge (*Carex filifolia*) are occasionally present in UPs13b and rare in the other types in this class. Terricolous lichens are sometimes common and are distinctive of UPs13b. UPs13b has been documented at numerous locations in the PPL, MIM, and CGP and at two locations in the southern part of the RRV just outside of the MIM. Description is based on summary of vegetation data from 86 plots.

Forbs

Scientific Name	Common Name	Scientific Name	Common Name
Anemone cylindrica	Long-headed thimbleweed	*Liatris punctata*	Dotted blazing star
Antennaria spp.	Pussytoes	*Liatris cylindracea*	Cylindric blazing star
Aquilegia canadensis	Columbine	*Linum sulcatum*	Grooved yellow flax
Asclepias verticillata	Whorled milkweed	*Lobelia spicata*	Rough-spiked Lobelia
Asclepias tuberosa	Butterfly-weed	*Lysimachia ciliate*	Fringed loosestrife
Asclepias viridiflora	Green milkweed	*Mirabilis hirsute*	Hairy four-o'clock
Asclepias syriaca	Common milkweed	*Monad fistulas*	Wild bergamot
Aster sericeus	Silky aster	*Another biennia*	Common evening-primrose
Aster Oolentan-giensis	Sky-blue aster	*Oenothera clelandii*	Cleland's evening-primrose

Aster ericoides	Heath aster	*Oxalis violacea*	Violet wood-sorrel
Aster laevis	Smooth aster	*Pediomelum esculentum*	Prairie-turnip
Astragalus Crassi-carpus	Buffalo-bean	*Pediomelum argophyllum*	Silvery scurf-pea
Calylophus serrulata	Toothed evening primrose	*Penstemon grandiflorus*	Large-flowered beard-tongue
Campanula rotundifolia	Harebell	*Physalis virginiana*	Ground-cherry
Coreopsis palmata	Stiff tickseed	*Potentilla arguta*	Tall cinquefoil
Dalea purpurea	Purple prairie-clover	*Pycnanthemum virginianum*	Virginia mountain-mint
Dalea candida	White prairie-clover	*Scutellaria leonardi*	Leonard's skullcap
Delphinium carolini-anum	Prairie larkspur	*Senecio plattensis*	Prairie ragwort
Desmodium illinoense	Illinois tick-trefoil	*Silene antirrhina*	Sleepy catchfly
Euphorbia corollata	Flowering spurge	*Sisyrinchium campestre*	Field blue-eyed grass
Gnaphalium Obtuse-folium	Sweet everlasting	*Solidago nemoralis*	Gray goldenrod
Helianthemum bicknellii	Hoary frostweed	*Solidago rigida*	Stiff goldenrod
Helianthus pauciflorus	Stiff sunflower	*Solidago speciosa*	Showy goldenrod
Heuchera richardsonii	Alum-root	*Tradescantia occidentalis*	Western spiderwort
Hypericum perforatum	Common St. John's-wort	*Viola pedatifida*	Prairie bird-foot violet
Kuhnia eupato-roides	False boneset	*Viola pedata*	Bird-foot violet
Lespedeza capitata	Round-headed bush-clover	*Zizia aptera*	Heart-leaved alexanders
Liatris aspera	Rough blazing star	*Liatris cylindracea*	Cylindric blazing star
Grasses and Sedges			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Andropogon gerardii	Big bluestem	*Panicum oligosanthes*	Few-flowered panic grass
Bouteloua curtipendula	Side-oats grama	*Panicum wilcoxianum*	Wilcox's panic grass
Bouteloua hirsuta	Hairy grama	*Panicum perlongum*	Long-leaved panic grass
Calamovilfa longifolia	Sand reed-grass	*Panicum linearifolium*	Linnear-leaved panic grass
Carex pensylvanica	Sunshine sedge	*Panicum leibergii*	Leiberg's panic grass
Cyperus schweinitzii	Schweinitz' cyperus	*Schizachyrium scoparium*	Little bluestem
Cyperus lupulinus	Hop-like cyperus	*Sorghastrum nutans*	Indian grass

Elymus wiegandii	Canada wild rye	*Sporobolus heterolepis*	Prairie dropseed
Eragrostis spectabilis	Purple lovegrass	*Sporobolus asper*	Rough dropseed
Muhlenbergia cuspidata	Plains muhly	*Stipa spartea*	Porcupine-grass
Shrubs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Rosa cmx	Smooth wild rose	*Amorpha canescens*	Lead-plant

UNITS 3 and 4: Southern Mesic Prairie (UPs23)			
Ups23 description: Grass-dominated but forb-rich herbaceous communities on somewhat poorly drained to well-drained loam soils mainly formed in unsorted glacial till, sometimes in a thin loess layer over till, and locally in lacustrine sediments and outwash deposits. Communities in this class occur primarily on level to gently rolling sites. Drought stress is irregular in occurrence and usually not severe.			
Forbs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Allium stellatum	Prairie wild onion	*Allium canadense*	Wild Garlic
Anemone cylindrica	Long-headed thimbleweed	*Anemone virginiana*	Virginia Thimbleweed
Anemone candensis	Canada anemone	*Antennaria spp.*	Pussytoes
Apocynum androsaemifolium	Spreading dogbane	Artemisia frigida	Prairie Sagewort
Asclepias tuberosa	Butterfly weed	*Asclepias syriaca*	Common milkweed
Aster oolentangiensis	Skyblue aster	*Aster ericoides*	Heath aster
Aster lanceolatum	Panicled Aster	*Aster novae-angliae*	New England Aster
Aster laevis	Smooth blue aster	*Astragalus canadensis*	Canada Milkvetch
Campanula rotundifolia	Harebell	*Chryysopsis villosa*	Prairie golden Aster
Comandra umbellata var. umbellata	Bastard toadflax	*Coreopsis palmata*	Stiff Tickseed
Dalea purpurea var. purpurea	Purple prairie clover	*Dalea candida*	White prairie clover
Desmodium canadense	Canada tick trefoil	*Euphorbia corollata*	Flowering Spurge
Euthamia graminfolia	Grass-leaved goldenrod	*Fragaria virginiana*	Common strawberry
Galium boreale	Northern bedstraw	*Gantiana balingtoni*	Closed Gentian
Geum triflorum	Prairie Smoke	*Helenium autumnale*	Autumn Sneezeweed
Helianthus maximiliani	Maximilian's sunflower	*Helianthus pauciflorus*	Stiff sunflower

Heliopsis helianthoides var. scabra	Ox-eye	*Heuchera richardsonii*	Alumroot
Lathyrus venosus	Veiny Pea	*Lespedeza capitata*	Round-headed Bush-clover
Liatris aspera	Rough blazing star	*Liatris ligulistylis*	Northern plains blazing star
Liatris pycnostachya	Gay Feather	*Lilium philadelphicum var. andinum*	Wood lily
Lobelia spicata	Rough Spiked Lobelia	*Mirabilis hirsuta*	Hairy four o'clock
Monarda fistulosa	Wild bergamot	*Oenothera biennis*	Common evening-primrose
Pedicularis canadensis	Wood betony	*Phlox pilosa var. fulgida*	Prairie phlox
Physalis heterophylia	Clammy Ground-cherry	*Polygala polygala*	Racemed milkwort
Potentilla arguta	Tall cinquefoil	*Pycnanthemum virginianum*	Virginia mountain mint
Ratibida pinnata	Gray-headed coneflower	*Rudbeckia hirta*	Black-eyed Susan
Sisyrinchium compestre	Field blue-eyed grass	*Smilacina stellata*	Starry False Solomon Seal
Smilacina racemosum	False Solomon's Seal	*Solidago nemoralis*	Gray goldenrod
Solidago missouriensis	Missouri goldenrod	*Solidago ptarmicoides*	Upland White Aster
Solidago speciosa	Showy goldenrod	*Thalictrum dasycarpum*	Tall meadow-rue
Tradescantia bracteata	Bracted Spiderwort	*Veronicastrum virginicum*	Culver's Root
Vicia americana	American vetch	*Viola pedata*	Prairie Bird-foot Violet
Zizia aptera	Heart-leaved alexanders	*Artemisia campestris*	Tall wormwood
Grasses, Rushes, and Sedges			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Andropogon gerardii	Big bluestem	*Bromus kalmii*	Kalm's Brome
Carex bicknellii	Bicknell's Sedge	*Carex muehlenbergii*	Muhlenberg's Sedge
Carex meadii	Mead's Sedge	Carex tenera	Remote Sedge
Elymus canadensis	Canada Wild Rye	*Elymus trachycaulus*	Slender wheatgrass
Eragrostis spectabilis	Purple Lovegrass	*Muhlenbergia mexicana*	Mexican satin-grass
Panicum oligosanthes	Few-flowered Panic grass	*Panicum virgatum*	Switchgrass
Panicum perlongum	Long-leaved panic grass	*Schizachyrium scoparium var. scoparium*	Little bluestem
Sorghastrum nutans	Indian grass	*Sporobolus heterolepis*	Prairie dropseed
Stipa spartea	Porcupine grass		
Semi-Shrubs (Generally common)			

Scientific Name	Common Name	Scientific Name	Common Name
Amorpha canescens	Leadplant (generally common)	*Rosa arkansana*	Prairie rose
Shrubs (Occasional)			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Symphoricarpos occidentalis	Wolfberry		
Shrubs (Rare)			
Cornus racemosa	Grey Dogwood	*Corylus americana*	American Hazelnut

UNITS 5 and 6: Southern-Mesic Oak-Basswood Forest (MHs38) MHs38b Basswood - Bur Oak - (Green Ash) Forest does not include its own species list			
MHs38 description: Mesic hardwood or, occasionally, hardwood-conifer forests. Present on wind-deposited silt on bedrock bluffs, on calcareous till on rolling till plains, and, rarely, in association with natural fire breaks in prairie landscapes or on weakly calcareous till on stagnation moraines.			
MHs38b Basswood - Bur Oak - (Green Ash) Forest description: Mesic hardwood forests on hummocky topography or near lakes on till plains and stagnation moraines; slopes are generally not steep. Canopy most often is dominated by basswood, bur oak, or green ash, with northern red oak abundant in a few stands. Subcanopy and shrub layer have abundant ironwood with occasional basswood. In general, MHs38b can often be distinguished from the other types in this class by the presence of abundant green ash in the canopy and abundant Virginia waterleaf in the ground layer. It is further distinguished from MHs38c by lower frequency of northern red oak and almost complete lack of sugar maple in the canopy. Additional species that can help to distinguish MHs38b include snowberry or wolfberry (*Symphoricarpos albus* or *S. occidentalis*), starry false Solomon's seal (*Smilacina stellata*), and nodding trillium (*Trillium cernuum*). MHs38b has been documented in the MIM, CGP, and RRV. Description is based on summary of vegetation data from 43 plots.			
Forbs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Actaea rubra	Red Baneberry	*Allium tricoccum*	Wild leek
Amphicarpaea bracteata	Hog-peanut	*Anemone quinquefolia*	Wood anemone
Anemone acutilobe	Sharp-lobed hepatica	*Anemone americana*	Round-leaved hepatica
Aplectrum hyemale	Putty-root	*Apocynum androsaemfolium*	Spreading dogbane
Aquilegia canadensis	Columbine	*Aralia nudicaulis*	Wild sarsaparilla
Aralia racemosa	American spikenard	*Arisaema triphyllum*	Jack-in the-pulpit
Asarum canadense	Wild Ginger	*Asclepias exaltata*	Poke Milkweed

Aster cordifolius	Heart-leaved Aster	*Aster macrophylius*	Large-leaved aster
Aster lateriflorus	Side-flowering Aster	*Aster sagittifolus*	Tall-leaved aster
Campanula americana	Tall bellflower	*Campanula rotundifolia*	Harebel
Cardamine concatenata	Cut-leaved toothwort	*Caulophyllum thalictroides*	Blue Cohosh
Cryptotaenia canadensis	Honewort	*Desmodium glutinosum*	pointed-leaved tick-trefoil
Dicentra cucullania	Dutchman's Breeches	*Dioscorea vilosa*	Wild Yam
Eupatorium rugosum	Common Snakeroot	*Fragaria virginiari*	Common Strawberry
Galium boreale	Northern bedstraw	*Geranium maculatum*	Wild Geranium
Helianthus pauciflorus	Stiff sunflower	*Lilium michiganense*	Michigan lily
Maianthemum canadense	Canada mayflower	*Orchis spectabilis*	Showy orchis
Osmorhiza claytonii	Clayton's sweet cicely	*Pedicularis canadnesis*	Wood betony
Phlox divancata	Blue Phlox	*Phryma leptostachya*	lopseed
Polygonatum biflorum	Giant Solomon's Seal	*Pyrola elliptica*	Common pyrola
Rudbeckia lacinata	Goldenglow	*Sanguinaria canadensis*	Bloodroot
Smilacina racemosa	False Solomon's seal	*Solidago flexicaulis*	Zig-zag goldenrod
Strophostyles helvola	Wild bean	*Thalictrum dioicum*	Early Meadow-rue
Thalictrum thalictroides	Rue-anemone	*Trillium cernuum*	Nodding trillium
Trillium grandiflorum	Large-flowered trillium	*Uvularia grandifloria*	Yelloe belwort
Uvularia sessilifolia	Pale belwort	*Uvularia virginicum*	Culver's root
Grasses and Sedges			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Carex pedunculata	Long-stalked sedge	*Carex pensylvanica*	Pennsylvania sedge
Carex blanda	Charming Sedge	*Carex gracilima*	Graceful sedge
Carex deweyana	Dewey's Sedge	*Carex sprengelli*	Sprengel's Sedge
Carex radiata	Stellate Sedge	*Carex rosea*	Rolled-up sedge
Elymus hystrix	Bottlebrush grass	*Elymus virginicus*	Virginia Wild Rye
Festuca subverticullata	Nodding fescue	*Leersia virginica*	White grass
Cryzopsis racemosa	Black-fruited rice-grass	*Cryzopsis asperfolia*	Mountain rice-grass

Schizachne purpurascens	False Melic grass		
Ferns			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Athyrium filix-femina	Lady fern	*Adiantum pedatum*	Maidenhair fern
Cismunda claytonia	Interrupted Fern		
Vines			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Celastrus scadens	Climbing bittersweet	*Lonicera prolifera*	Grape honeysckle
Shrubs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Amelanchier cmx.	Juneberry	*Cornus alternifolia*	Pagoda dogwood
Cornus racemosa	Gray dogwood	*Corylus cornuta*	Beaked Hazelnut
Corylus americana	American Hazelnut	*Diervilla lonicera*	Bush honeysuckle
Lonicera dioica	Wild honeysuckle	*Prunus virginiana*	Chokecherry
Sambucus canadensis	Common Elder	*Sambucus racemosa*	Red-berried elder
Staphylea trifolia	Bladdernut	*Symphoricarpos cmx*	Snowberry
Vibernum rafinesquianum	Downy arrow-wood	*Vibernum lentago*	Nannyberry
Vibernum opolus	High-bush cranberry	*Zanthoxylum americanum*	Prickly Ash
Trees			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Acer saccharum	Sugar Maple	*Betula papyrifera*	Paper birch
Carpimus caroiniaria	Blue Beech	*Carya cordiformes*	Bitternut hickory
Celtis occidentalis	Hackberry	*Ostrya virginiana*	Ironwood
Populus tremuloides	Quaking Aspen	*Populus grandidentata*	Big-tooth Aspen
Prunus serotina	Black cherry	*Quercus rubra*	Northern red oak
Quercus alba	White oak	*Quercus macrocarpa*	Bur oak
Tillia Americana	American Basswood		

UNITS 7: Southern Terrace Forest (FFs59) FFs59a Silver Maple - Green Ash - Cottonwood Terrace Forest does not include its own species list			
FFs59 description: Wet-mesic deciduous forests on silty or sandy alluvium on level, occasionally flooded sites along small streams to large rivers in the southern half of Minnesota.			
FFs59a Silver Maple - Green Ash - Cottonwood Terrace Forest description: Present on terraces of medium to large rivers. The most common canopy trees are American elm, silver maple, box elder, and green ash, with occasional cottonwood and hackberry. Most of these species are also important in the understory. Important shrubs include wahoo (*Euonymus atropurpureus*), red-berried elder (*Sambucus racemosa*), hawthorns (*Crataegus* spp.), and prickly gooseberry (*Ribes cynosbati*). Important ground-layer species include Ontario aster (*Aster ontarionis*), jack-in-the-pulpit (*Arisaema triphyllum*), Maryland black snakeroot (*Sanicula marilandica*), Clayton's sweet cicely (*Osmorhiza claytonii*), early meadow-rue (*Thalictrum dioicum*), and virgin's bower (*Clematis virginiana*). Documented in the Blufflands Subsection in the PPL and in the Anoka Sand Plain and Oak Savanna Subsections in the MIM. Description is based on summary of vegetation data from 13 plots.			
Forbs, Ferns and Fern Allies			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Laportea canadensis	Wood nettle	*Hydrophyllum virginianum*	Virginia waterleaf
Impatiens spp.	Touch-me-not	*Rudbeckia laciniata*	Tall coneflower
Urtica dioica	Stinging nettle	*Galium aparine*	Cleavers
Cryptotaenia canadensis	Honewort	*Geum canadense*	White avens
Osmorhiza longistylis	Aniseroot	*Phlox divaricata*	Blue phlox
Polygonum virginianum	Virginia knotweed	*Viola sororia* and similar *Viola* spp.	Stemless blue violets
Smilax ecirrata, S. herbacea, or S. illinoensis	Erect, Smooth, or Illinois carrion-flower	*Arisaema triphyllum*	Jack-in-the-pulpit
Viola canadensis or V. pubescens	Rugulose or Yellow violet	*Enemion biternatum*	False rue anemone
Pilea spp.	Clearweed	*Ranunculus hispidus*	Hispid buttercup
Circaea lutetiana	Common enchanter's nightshade	*Aster ontarionis*	Ontario aster
Sanicula gregaria	Gregarious black snakeroot	*Sanicula marilandica*	Maryland black snakeroot
Heracleum lanatum	Cow parsnip	*Galium triflorum*	Sweet-scented bedstraw
Osmorhiza claytonii	Clayton's sweet cicely	*Amphicarpaea bracteata*	Hog peanut
Blephilia hirsuta	Woodmint	*Thalictrum dioicum*	Early meadow-rue
Smilacina stellata	Starry false Solomon's seal	*Mertensia virginica*	Virginia bluebells
Matteuccia struthiopteris	Ostrich fern	*Geranium maculatum*	Wild geranium

Grasses and Sedges			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Elymus virginicus	Virginia wild rye	*Carex amphibola*	Ambiguous sedge
Carex blanda	Bland sedge	*Festuca subverticillata*	Nodding fescue
Leersia virginica	White grass	*Carex rosea*	Starry sedge
Carex grayi	Gray's sedge		
Woody Vines			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Parthenocissus spp.	Virginia creeper	*Vitis riparia*	Wild grape
Smilax tamnoides	Greenbrier	*Menispermum canadense*	Canada moonseed
Shrubs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Ribes missouriense	Missouri gooseberry	*Zanthoxylum americanum*	Prickly ash
Sambucus canadensis	Common elder	*Prunus virginiana*	Chokecherry
Toxicodendron rydbergii	Poison ivy	*Viburnum lentago*	Nannyberry
Ribes cynosbati	Prickly gooseberry	*Crataegus spp.*	Hawthorn
Trees			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Ulmus americana	American elm	*Acer negundo*	Box elder
Acer saccharinum	Silver maple	*Fraxinus pennsylvanica*	Green ash
Celtis occidentalis	Hackberry	*Tilia americana*	Basswood
Populus deltoides	Cottonwood	*Fraxinus nigra*	Black ash
Ulmus rubra	Red elm	*Quercus bicolor*	Swamp white oak
Carya cordiformis	Bitternut hickory	*Juglans nigra*	Black walnut

UNITS 7: Southern Floodplain Forest (FFs68)
FFs68 description: Deciduous riparian forests on sandy or silty alluvium on low, level, annually flooded sites along medium and large rivers in the southern half of Minnesota. Community is

characterized by evidence of recent flooding such as rows and piles of debris, ice scars on trees, high-water channels, and freshly deposited silt and sand.

Forbs, Ferns and Fern Allies			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Laportea canadensis	Wood nettle	*Cryptotaenia canadensis*	Honewort
Aster ontarionis	Ontario aster	*Scutellaria lateriflora*	Mad dog skullcap
Bidens spp.	Bur marigold and Beggarticks	*Ranunculus abortivus*	Kidney-leaved buttercup
Impatiens spp.	Touch-me-not	*Rudbeckia laciniata*	Tall coneflower
Stachys tenuifolia	Narrow-leaved hedge nettle	*Boehmeria cylindrica*	False nettle
Echinocystis lobata	Wild cucumber	*Hackelia deflexa or H. virginiana*	Nodding or Virginia stickseed
Lycopus uniflorus	Northern bugleweed	*Aster lateriflorus*	Side-flowering aster
Cuscuta spp.	Dodder	*Campanula americana*	Tall bellflower
Teucrium canadense	Germander	*Sicyos angulatus*	Bur cucumber
Stachys palustris	Woundwort	*Lycopus americanus*	Cut-leaved bugleweed
Aster lanceolatus	Eastern panicled aster	*Arisaema dracontium*	Green dragon
Eupatorium rugosum	White snakeroot	*Viola sororia and similar Viola spp.*	Stemless blue violets
Mentha arvensis	Common mint	*Acalypha rhomboidea*	Three-seeded mercury
Urtica dioica	Stinging nettle	*Iris virginica*	Southern blue flag
Polygonum virginianum	Virginia knotweed	*Smilax ecirrata, S. herbacea, or S. illinoensis*	Erect, Smooth, or Illinois carrion-flower
Pilea spp.	Clearweed		
Grasses and Sedges			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Elymus virginicus	Virginia wild rye	*Carex amphibola*	Ambiguous sedge
Leersia oryzoides	Rice cut grass	*Carex lupulina*	Hop umbrella sedge
Leersia virginica	White grass	*Carex typhina*	Cattail sedge
Carex grayi	Gray's sedge	*Carex intumescens*	Bladder sedge
Cinna arundinacea	Stout woodreed		
Climbing Plants			

Scientific Name	Common Name	Scientific Name	Common Name
Parthenocissus spp.	Virginia creeper	*Vitis riparia*	Wild grape
Smilax tamnoides	Greenbrier	*Menispermum canadense*	Canada moonseed
Toxicodendron rydbergii	Climbing poison ivy		
Shrubs			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Toxicodendron rydbergii	Climbing poison ivy	*Salix nigra*	Black willow
Trees			
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Ulmus americana	American elm	*Acer negundo*	Box elder
Acer saccharinum	Silver maple	*Fraxinus pennsylvanica*	Green ash
Celtis occidentalis	Hackberry	*Quercus bicolor*	Swamp white oak
Populus deltoides	Cottonwood	*Ulmus rubra*	Red elm

APPENDIX C. Methods for controlling non-native and invasive plant species

TREES and SHRUBS

Common buckthorn (*Rhamus cathartica*), Tatarian honeysuckle (*Lonicera tatarica*), Siberian elm (*Ulmus pumila*), and black locust (*Robinia pseudoacacia*) are some of the most common woody species likely to invade native woodlands or prairies in Minnesota. All are prolific seeders, lack natural disease and predators, and can out-compete native species. Invasions result in dense, impenetrable thickets or nearly monotypic stands that reduces native species diversity.

Biological Control

Currently, there are no biological control agents for non-native woody plants in Minnesota. An 11-year study conducted by the DNR and the University of MN resulted in the conclusion that there were no viable biological control agents for common or glossy buckthorn, based in part on the lack of damage to the host plants and a lack of host specificity (http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/biocontrol.html).

Chemical Control

The most efficient way to remove woody plants that are 1/2 inch or more in diameter is to cut the stems close to the ground and treat the cut stumps with herbicide immediately after they are cut, when the stumps are fresh, and the chemicals are most readily absorbed. Failure to treat the stumps will result in resprouting, creating much greater removal difficulty. Herbicide should be applied to cut stumps with a dauber or sponge-type applicator, to minimize effects to non-target species.

In non-freezing temperatures, a triclopyr (e.g., Garlon 3a) or glyphosate (e.g Roundup) herbicide is typically used. Adding a marker dye can help to make treated stumps more visible. In winter months, Garlon 4 is typically used, and it must be mixed with a penetrating oil, such as diluent blue. Do not use diesel fuel, as it is much more toxic in the environment and for humans. For plants in the pea family, such as black locust, an herbicide with the active ingredient clopyralid is used. Common brand names for are Transline, Stinger, and Reclaim.

Brush removal work can be done at any time of year except during spring sapflow, but late fall is often ideal because buckthorn retains its leaves longer than other species and is more readily distinguished from other species. Cutting can be accomplished with brush cutters and chainsaws, used only by properly trained professionals.

Basal bark herbicide treatment is another effective control method for invasive woody plants, especially moderately large stems. A triclopyr herbicide such as 10% Garlon 4, mixed with a penetrating oil, is applied all around the base of the tree or shrub, taking care so that it does not run off. If the herbicide runs off it can kill other plants nearby. More herbicide is needed for

effective treatment of plants that are four inches or more in diameter. Herbicide should be applied with daubers to avoid non-target impacts.

Mechanical Control

The most common method of mechanical control of woody plants is forestry mowing. Forestry mowing should be done on frozen ground. It is best done with little or no snow cover. The critical factor is that the mower must get down to the soil surface as much as possible, even scuffing the soil slightly, so that the mower is chewing up the root collar of the invasive woody plants. It requires going back and forth over an area, leaving no punji sticks, and cut debris should be well mulched.

Hand removal of plants by hand-pulling small plants or using weed wrenches may be suitable for very small, targeted areas or a home setting, but is generally not suitable for a large-scale project.

Undesirable trees and shrubs can also be destroyed by girdling. This method is most suitable for small numbers of large trees. Bark is removed in a band around the tree, just to the cambium. If girdled too deeply, the tree will respond by resprouting from the roots. Girdled trees die slowly over the course of one to two years. Girdling should be done in late spring to mid-summer when sap is flowing and the bark easily peels away from the sapwood. Herbicide can also be used in combination with girdling for a more effective treatment.

Repeated cutting of woody plants (by hand or with a brush cutter) at critical stages in its growth cycle is another method to reduce smaller stems. Stems are cut in mid-spring (late May) to intercepts the flow of nutrients from the roots to the leaves and cut again in fall (about late-September) to intercepts the flow of nutrients from the leaves to the roots. If repeated for two years or more, this method will reduce small stems, especially if they are in deep shade. But it will also take out some other native woody and herbaceous plants and it ends up being quite costly, so it is generally not used on large sites.

Goats can also be used for mechanical control by browsing. The optimal timing late summer and/or late spring. As with cutting, it can help reduce buckthorn with repeated use over many years and is most successful where there is a dense tree canopy. It is best used in combination with other methods.

Stems, Seedlings and Resprouts

In the year following initial cutting, there will be a flush of new seedlings as well as resprouting from some of the cut plants. A good first step to deal with seedlings is fire. It also restores an important natural process to fire-dependant natural communities (e.g., oak forests). Burning can only be accomplished if adequate fuel (leaf litter) is present and can be done in late fall or early spring, depending on site conditions and in compliance with Section 7 guidance of the USFWS to avoid and minimize potential impacts to rusty patched bumble bee. Disadvantages to burning are that fire coverage is inconsistent over the site and there will be areas that are

missed. Fires are typically “cool” in order to be conducted safely, so that even very small stems sometimes survive and resprout.

When burning is not feasible or not totally effective, herbicide can be applied to the foliage of the plants. Early to mid-fall is the best time to do this, when desirable native plants are mostly dormant and when the target plant is pulling resources from the leaves down into the roots. Garlon (triclopyr) is the most commonly used herbicides for foliar application. As with any herbicide, caution should be used with Garlon, because the surfactants added that allow it to penetrate bark also seep into the soil and may affect other plants within a radius of the treated plant. Herbicides are also known to be detrimental to soil microorganisms, which are vital for plant growth. For this reason, a wick application may be a better method than broadcast spraying, depending on what the groundcover composition is. Krenite (active ingredient – fosamine ammonium) is another herbicide that prevents bud formation, so the plants do not grow in the spring. This herbicide can be effective, but results are highly variable.

Disposal

If removing stems using some form of cut-and-paint removal, the easiest and most cost-effective method to handle large amounts of brush is usually to stack and burn it in winter. In areas where brush is not dense, it can be cut up into smaller pieces and left on the ground where it will decompose in one to three years. This method is especially useful on slopes to reduce erosion potential. Small brush piles can also be left in the woods as wildlife habitat piles. Where there is an abundance of larger trees, cut trees may be hauled and chipped and used for mulch or as a biofuel. Alternatively, the wood can be cut and used for firewood, if a recipient can be found.

FORBS

*Birdsfoot trefoil (*Lotus corniculatus*)*

Birdsfoot trefoil forms dense mats that choke out most other vegetation. It is especially problematic in prairies and disturbed open areas. Prescribed burns increase seed germination making it difficult to manage in native prairies. It can best be controlled with a combination of mowing or burning and chemical application. An effective broadleaf herbicide for legumes is aminopyralid (e.g., Milestone). Note that aminopyralid herbicides also affects species in the sunflower family.

*Spotted knapweed (*Centaurea maculosa*)*

Spotted knapweed is a very aggressive invasive species that is difficult to control. It is a biennial or short-lived perennial plant with very prolific seed production and allelopathic compounds in the roots that prevent other species from growing nearby. Hand-pulling individuals or small groups of individuals can be effective for small infestations and is often a good volunteer group task. However, knapweed has a fairly large tap root and can be difficult to pull. Pulling is typically most feasible in sandy soil or in heavier soil after a rain. All flowering plants must be pulled every year for about five years until the seedbank is exhausted.

If knapweed populations are large, a biocontrol is recommended. A combination of knapweed root weevils (*Cyphocleonus achates*) and seedhead weevils (*Larinus minutus/obtusus*) is best. Results from biological control typically take 4-6 years to see. The knapweed will not be eradicated, but will be reduced so that native species diversity is not impeded. Weevils can be purchased online and are released during the summer. Knapweed populations should be monitored each year to keep a record of the effectiveness of the biocontrol.

For immediate control of small populations, spot treatment with a systemic herbicide such as glyphosate, milestone or transline may be needed. Picloram herbicides are also effective, but they have a long soil residual, and we recommend avoiding them. A 2-5% glyphosate solution applied to basal rosettes is very effective. The optimal season is late fall when plants are moving resources to the roots and most natives are dormant. The fall spray can be preceded by a late June mowing, to reduce flowering and seeding of second-year plants. Herbicide can also be used on basal rosettes after a spring burn. However, solid stands of knapweed do not carry a fire very well and the dead vegetation may not get burned off. Knapweed itself cannot be controlled with burning—like sweet clover it actually increases with fire.

*Canada thistle (*Cirsium arvense*)*

While native thistles are not problematic, invasives such as Canada thistle are clone-forming perennials that can greatly reduce species diversity in old fields and restoration areas. A combination of chemical and mechanical control methods may be needed. The two-step process is to cut or mow the stems when they are flowering in June/July, then apply herbicide to the basal rosettes in fall. Chemical control is most effective when the plants are in the rosette stage and least effective when the plants are flowering. A clopyralid herbicide such as Transline is very effective. An aminopyralid (e.g., Milestone) can be applied at bud stage. Aminopyralid has longer residual activity than some other chemicals, so should avoid using in areas of higher diversity.

Mechanical control, involving several cuttings per year for three or four years, can reduce an infestation if timed correctly. The best time to cut is when the plants are just beginning to bud because their food reserves are at their lowest. If plants are cut after flowers have opened, the cut plants should be removed because viable seed may form. Plants should be cut at least three times throughout the season. Late spring burns can also discourage this species, but early spring burns can encourage it. Burning may be more effective in an established prairie, where competition from other species is strong, rather than in an old field, where competition is likely to be weaker.

*Garlic mustard (*Alliaria petiolata*)*

Garlic mustard is a nonnative biennial forb of woodlands and woodland edges that is very invasive. It tends to invade disturbed soils most readily, especially following earthworm invasions that leave the ground devoid of vegetation. It is recommended to monitor and remove it as soon as it is detected (early detection and rapid response). Garlic mustard also produces a flavonoid (root exudate) that suppresses myccorhizal inoculation. Thus, species that

are myccorhizae dependent, like oaks, will become stunted and easily outcompeted by garlic mustard. The flavinoid persists in the soil years after garlic mustard plants are removed.

Hand-pulling should occur before siliques (seed pods) form. Once flowers form, removed plants should be bagged and transported from the site, since the plant may have enough energy in the stem and root to make viable seeds. When pulling the plants, the entire root must be removed or they may re-sprout. This can be difficult since roots are "S-shaped" and tend to break off at ground level.

Chemical control can be effective for expansive infestations where hand-pulling is not feasible. Glyphosate is non-specific and very effective but will also kill non-target plants. The key thing is to apply treatment very late in the fall or very early in the spring. Garlic mustard stays green through the winter so when there is no snow cover it can be virtually the only green plant. Another option is to use a water-soluble broadleaf herbicide, like triclopyr (Garlon), which will not kill grasses or sedges.

Garlic mustard can also be controlled by goats. Goats would be brought in at the specific time when the plants are flowering but not producing mature seed. Goats would be removed as soon as grazing is complete and would be used in subsequent years as needed. Seeding after garlic mustard removal will help to suppress it.

Recently completed research at the University of Minnesota shows good potential for bio-control of garlic mustard via two European weevils in the genus *Ceutorhynchus* (https://mitppc.umn.edu/research/research-projects/garlic-mustard-biocontrol-ecological-host-range-biocontrol-agents). *Ceutorhynchus scrobicollis* and *Ceutorhynchus constrictus* are known to feed on garlic mustard's leafy crown and seeds, respectively. Regulatory approval to release these weevils is not complete in the US. If approved, this method could revolutionize garlic mustard control. However, whether it will be effective or not on a landscape scale is yet to be determined.

GRASSES

Smooth brome (Bromus inermis)*, Kentucky bluegrass, and creeping fescue*

Smooth brome, Kentucky bluegrass, and creeping fescue are some of the most common non-native, invasive grasses. All are cool season species - active early in the growing season (April-June) and semi-dormant July-September. Many of them reproduce by means of underground stems (stolons and rhizomes) called "tillers". The most effective treatments are timed to occur at the same time as "tillering" - mid to late May. A late spring burn can set back the non-native grasses, while warming the ground and giving native grasses a boost just when they are ready to emerge from the ground. Within a few weeks, summer conditions will be most favorable for the native warm-season grasses, and further detrimental to cool season grasses. Burning two years in a row followed by seeding has been shown to be effective in controlling smooth brome. Consider that this timing may be a week or two earlier on steep south-facing slopes or

in very sandy or sand-gravel soils. Late spring burns, however, are hard on native forbs so that should be a careful consideration. After burning, seeding with native local ecotype seed is important for restoring native. Evaluation can occur each year, and especially after two years.

Another option, especially if there are a lot of desirable native forbs, is a cool-season overspray with a broad-spectrum herbicide (e.g., glyphosate) or a grass-specific herbicide either in the spring (April) or in the fall (October).

All herbicides should be applied by licensed applicators and should not be applied on windy days.

Reed canary grass (Phalaris arundinacea)

Reed canary grass is extremely difficult to eradicate and requires repeated treatment over a period of one to three years. A combination of burning, chemical treatment and mowing can be used, in accessible areas, or chemical treatment alone in inaccessible areas. The combination method starts by burning in late spring to remove dead vegetation and to stimulate new growth. When new sprouts have reached a height of 4 to 6 inches, the site can be sprayed with a 5% solution of a glyphosate herbicide appropriate for wetland habitat (e.g., Rodeo). The site is then mowed in late summer, followed by chemical application after re-growth. This treatment will stimulate new growth and germination to deplete the seed bank. The sequence of chemical treatment and mowing are repeated for at least a second season, and possibly a third until the grass is completely eradicated. Then native grass and forb seed can be broadcast or drilled. Reed canary areas should continue to be monitored mapped and treated.

APPENDIX D. Ecological Contractors

Following is a list of contractors to consider for implementing the management plans. While this is not an exhaustive list, it does include firms with ecologists who are very knowledgeable with natural resource management. Unless otherwise noted, all firms do prescribed burning. Many other brush removal companies are listed in the yellow pages (under tree care), but most do not have knowledge or understanding of native plant communities. We recommend hiring firms that can provide ecological expertise.

Friends of the Mississippi River has extensive experience working with landowners to implement natural resource management plans. FMR can assist landowners with obtaining funding for restoration and management projects and providing project management, including contractor negotiations, coordinating restoration and management work, and site monitoring and evaluation.

Conservation Corps Minnesota
60 Plato Blvd E Ste 210
Saint Paul, MN 55107
(651) 209-9900
www.conservationcorps.org

Great River Greening
251 Starkey St #2200
St Paul, MN 55107
(651) 665-9500
www.greatrivergreening.org

Minnesota Native Landscapes (MNL)
8740 77th St NE
Otsego, MN 55362
(763) 295-0010
www.mnlcorp.com

Prairie Restorations, Inc.
31646 128th St.,
Princeton, MN 55371
(763) 389-4342
www.prairieresto.com

Stantec
733 Marquette Avenue, Suite 1000
Minneapolis, MN 55402
(612) 712-2000
www.stantec.com

Resource Environmental Solutions, LLC
20276 Delaware Avenue
Jordan, MN 55352
(217) 979-2415
www.res.us

Native Resource Preservation
260 Wentworth Ave E Suite 155
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Landbridge Ecological, Inc.
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